Ballville Dam Project,
Sandusky County, Ohio

Final Environmental Impact Statement

Prepared by
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In cooperation with

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August 2014

a.	Title:	Ballville Dam Project, Sandusky County, Ohio
b.	Subject:	Final Environmental Impact Statement
c.	Lead Agency:	United States Fish and Wildlife Service
d.	Cooperating Agencies:	U.S. Army Corps of Engineers Ohio Department of Natural Resources City of Fremont, Ohio Ballville Township, Ohio

e. Abstract:

Ballville Dam is currently a complete barrier to upstream fish passage and impedes hydrologic processes. The purpose for the issuance of federal funds and preparation of this EIS are to restore natural hydrological processes over a 40-mile stretch of the Sandusky River, re-open fish passage to 22 miles of new habitat, restore flow conditions for fish access to new habitat above the impoundment, and improve overall conditions for native fish communities in the Sandusky River system both upstream and downstream of the Ballville Dam, restoring self-sustaining fish resources.

On October 21, 2011, The U.S. Fish and Wildlife Service published a notice of intent to prepare a Draft EIS and request for comments in the Federal Register. The comment period for this notice ended on November 21, 2011 with many comments provided.

On January 24, 2014, the U.S. Fish and Wildlife Service published the Notice of Availability of the Draft EIS in the Federal Register (FR 79 4354), opening a 60 day public comment period. Comments were received from 29 individuals, organizations, and agencies, addressing a number of topics. The public comments and associated responses are available in Appendix B2 of this Final EIS.

Key issues identified during the public comment periods included cultural importance, disposition of sediment, susceptibility of area to flooding, ice jamming, impacts to water quality and fisheries, city water supply, and alternative ideas to utilize the structure.

The U.S. Fish and Wildlife Service has selected the Proposed Action—Incremental Dam Removal with Ice Control Structure as the preferred alternative. Of the alternatives evaluated in this EIS, this alternative best fulfills the agency’s statutory mission and responsibilities while meeting the purpose and need.

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g. Transmittal: This Environmental Impact Statement, prepared by the U.S. Fish and Wildlife Service Staff with Stantec Consulting Inc., in cooperation with the U.S. Army Corps of Engineers, the Ohio Department of Natural Resources, the City of Fremont and Ballville Township on the proposed removal of Ballville Dam for the Ballville Dam Project, Sandusky County, Ohio, is being made available to the public in August 2014. We request comments from the public on the Final EIS and related documents, which are available at the locations specified below.

We will accept comments received or postmarked within 30 days of publication of the notice of the Final EIS in the Federal Register. Comments must be received by 11:59 p.m. Eastern Time on the closing date. The U.S. Fish and Wildlife Service's decision on issuance of Federal funding will occur no sooner than 30 days after the publication of the Environmental Protection Agency's notice of the Final EIS in the Federal Register and will be documented in a Record of Decision.

You may obtain copies of the Final EIS and related documents on the Internet at:
http://www.fws.gov/midwest/fisheries/ballville-dam.html

You may obtain the documents by mail from the Fisheries Office in the Midwest Regional Office (see contact information above). To view hard copies of the documents in person, go to the Birchard Public Library during normal business hours; 423 Croghan Street, Fremont, Ohio 43420, (419) 334-7101.

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1.0 Purpose and Need for Action

1.1 INTRODUCTION

This Environmental Impact Statement (EIS) has been prepared by the U.S. Fish and Wildlife Service (Service), the lead agency, pursuant to the National Environmental Policy Act (NEPA) (42 U.S.C. §4321 et seq.). The City of Fremont (City), Ballville Township Trustees, Ohio Department of Natural Resources (ODNR), and the United States Army Corps of Engineers (USACE) have cooperated in the preparation of the Final EIS (FEIS) by reviewing and providing comments back to the Service.

This FEIS evaluates the effects of providing Federal funding to ODNR for removal of the Ballville Dam. The Service has sought to fund the project under the auspices of the Great Lakes Restoration Initiative (GLRI) through the Great Lakes Fish and Wildlife Restoration Act (Act)(16 U.S.C. 941 §4321 et seq.).

The GLRI is a driver for environmental action in the Great Lakes. Building upon strategic recommendations for how to improve the Great Lakes ecosystem presented in the Great Lakes Regional Collaboration Strategy of 2005, President Obama's FY 2010 budget invested $475 million for GLRI. Funding decreased to $300 million in FY 2011 and in FY 2012. GLRI represents a collaborative effort on behalf of the U.S. Environmental Protection Agency and 15 other federal agencies, including the Service, to address the most significant environmental concerns of the Great Lakes.

The Act authorizes the Service to work in partnership with States, Tribes, and other Federal agencies to develop and implement proposals for the restoration of fish and wildlife resources in the Great Lakes Basin and to provide assistance to Great Lakes fish and wildlife agencies to encourage cooperative conservation, restoration, and management of the fish and wildlife resources and their habitats. Fish and wildlife restoration projects are selected through a competitive review process from proposals submitted by States, Tribes, and other interested entities. Projects have focused on restoring wetlands; restoring aquatic habitat; fish community research and assessment; developing ecosystem management tools; and ecological monitoring and modeling.

The Act establishes six goals for Service programs related to Great Lakes fish and wildlife resources. Specifically, the Ballville Dam Project relates to goals 1 and 3 respectively:

1) Restoring and maintaining self-sustaining fish and wildlife resources.

2) Minimizing the impacts of contaminants on fishery and wildlife resources.

3) Protecting, maintaining, and, where degraded and destroyed, restoring fish and wildlife habitat, including the enhancement and creation of wetlands that result in a net gain in the amount of those habitats.

4) Stopping illegal activities adversely impacting fishery and wildlife resources.

5) Restoring threatened and endangered species to viable, self-sustaining levels.

6) Protecting, managing, and conserving migratory birds.

The Ballville Dam Project proposal was submitted for consideration by the ODNR. The proposal was selected for funding after undergoing a competitive rigorous review through pre- and full-proposal stages as well as independent anonymous peer review and comment. It was among 10, out of an initial 165 pre-proposals and 41 full proposals to receive funding through the Act on August 12, 2010. This funding would be utilized by ODNR, and through a sub-agreement, the City to directly carry out the project.

Additionally, the GLRI is the largest investment in the Great Lakes in two decades. In 2010, a task force of 16 federal agencies and many of the region's governors released the GLRI Action Plan covering five urgent issues called focus areas:

- Cleaning up toxics and areas of concern;
- Combating invasive species;
- Promoting near shore health by protecting watersheds from polluted run-off;
- Restoring wetlands and other habitats; and
- Tracking progress, education and working with strategic partners.

The Ballville Dam project, funded with GLRI resources, would help to address the restoration of the Great Lakes through aquatic habitat restoration in the Sandusky River.

The purpose of this FEIS is to disclose, evaluate, and explain the environmental effects of government actions to decision-makers and the public while ensuring that comments from the public are considered and integrated to the greatest extent practical. The FEIS describes and evaluates alternatives to achieve the purpose of the project. This document evaluates alternative methods of providing fish passage upstream/downstream of the Ballville Dam location, restoring natural hydrologic and sediment transport regimes, and addressing dam safety and liability.

1.2 NATIONAL ENVIRONMENTAL POLICY ACT

NEPA is a federal law that establishes a national environmental policy and provides a framework for planning and decision making by federal agencies. Specifically, NEPA requires that federal agencies integrate an interdisciplinary environmental review process that evaluates a range of alternatives, including the No Action Alternative, as part of the decision-making process. The purpose of NEPA is to ensure that the potential environmental impacts of any proposed federal action are fully considered and made available for the public to review. This process also establishes a need to include interagency coordination and public participation in the process. In summary, NEPA is intended to promote public participation and inform decision making by federal governmental agencies.

The Council on Environmental Quality (CEQ) was established under NEPA for the purpose of implementing and overseeing federal policies as they relate to this process.

Issuance of funding under the Act constitutes a discretionary federal action by the Service and is thus subject to NEPA. Due to the expectation of federal funds administered by the Service for use in removal of Ballville Dam, the Service is the lead Federal agency for the EIS. Other Cooperating Agencies include the City, Ballville Township Trustees, ODNR, and USACE.

In 1978 the CEQ issued Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 C.F.R. parts 1500-1508). Section 102(2) (C) of NEPA mandates that the lead federal agency must prepare a detailed statement (commonly called an Environmental Impact Statement [EIS]) for legislation and other major federal actions that significantly affect the quality of the human environment. Such projects include any actions under the jurisdiction of the federal government or subject to federal permits; actions requiring partial or complete federal funding; actions on federal lands or affecting federal facilities; continuing federal actions with effects on land or facilities; and new or revised federal rules, regulations, plans or procedures. Any action with the potential for significant impacts to the human environment requires the preparation of an EIS. Otherwise, an environmental assessment and finding of no significant impacts (FONSI) may be prepared under Section 102(2) (E) of NEPA.

The Service determined that an EIS was appropriate due to the scope of the project and the potential affected area. Additionally, the Service determined that the Ballville Dam is eligible for inclusion on the National Register of Historic Places, and its removal represents a significant impact on the human environment.

On January 24, 2014, the Environmental Protection Agency published the Notice of Availability of the Draft EIS (DEIS) in the Federal Register (FR 79 4158), opening a 60 day public comment period. Comments were received from 29 individuals, organizations, and agencies, addressing a number of topics. The public comments and associated responses are available in Appendix B2 of this FEIS.

The Service is issuing this FEIS for an additional 30-day public comment period. The Service will provide a concise record of its consideration of the environmental analysis in the Record of Decision (ROD). No Federal funding will be released until at least 30 days after completion of the ROD.

1.3 PROJECT BACKGROUND

1.3.1 Background of Dams near the City of Fremont and Ballville Township

1.3.1.1 Tucker Dam and Creager Dam

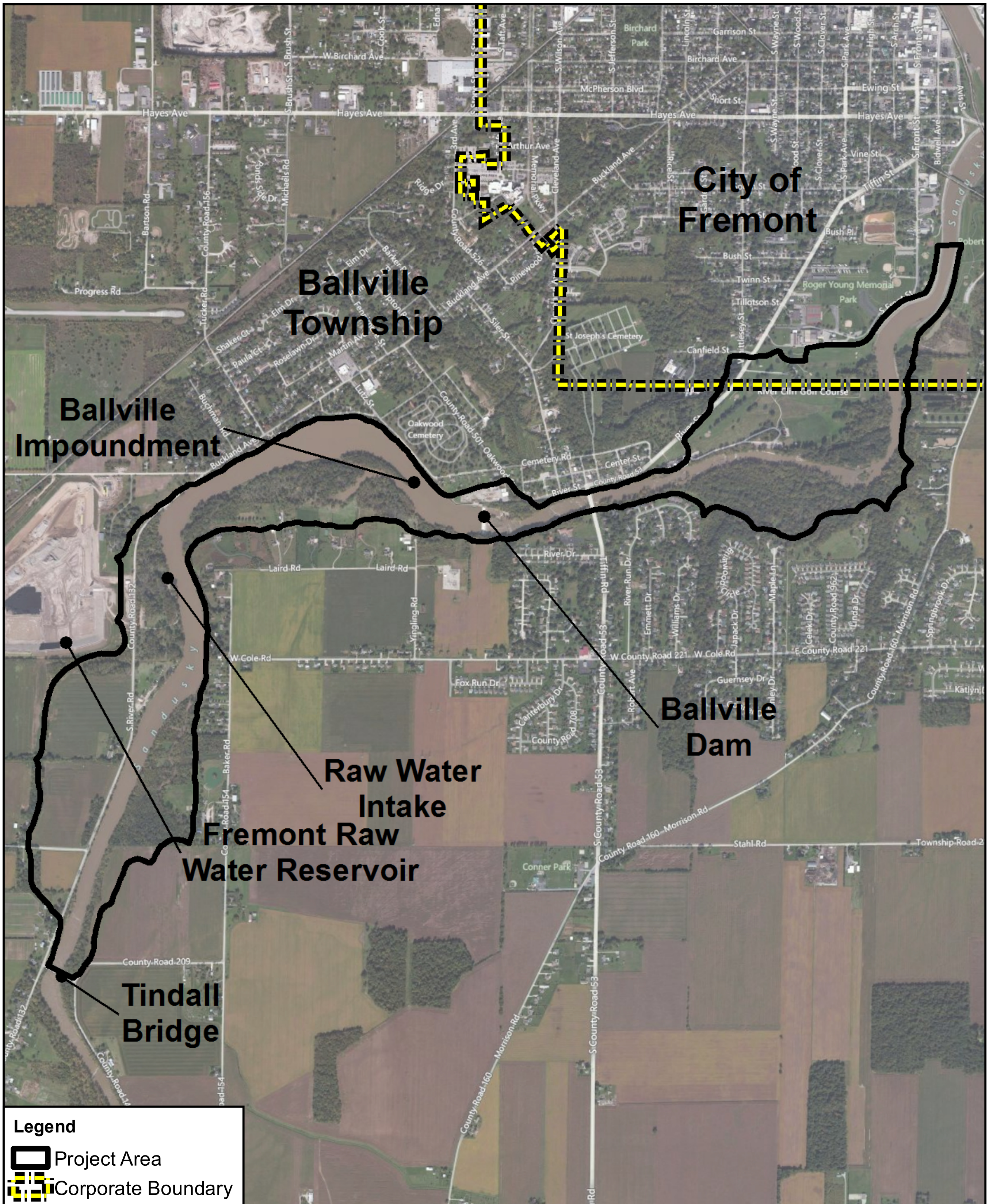
Numerous dams have been located over time both upstream and downstream of Ballville Dam (ASC 2011). The Tucker Dam was reportedly built between 1835 and 1858 and was a nine foot tall timber crib design that used water power to work a flour grist-mill. This dam and mill was reported to be operational into the early 1900's and was located within the current Ballville Dam impoundment. Bathymetric surveys conducted in 2011 in the Ballville impoundment detected the likely abutment of the old Tucker Mill upstream of the Ballville Dam but no other associated material (Stantec 2011b). The potential abutment remnants are located approximately eight feet below normal pool level of the impoundment. Further survey effort in 2013 by the ODNR also identified what appeared to be a concrete abutment in this vicinity, but no other discernible material was seen (Appendix A1).

The Creager Mill Dam was located downstream of the Ballville Dam. Little information is available on this dam. This dam was operational in the early 1800's and powered various wool works mills. It is believed that this dam was swept away by "great ice gorges occurring with floods" (Meek 1909). Its exact location is not known and no evidence (i.e. abutments, mill house, foundations) are in existence today.

1.3.1.2 Ballville Dam

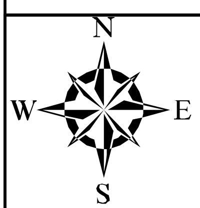
The Ballville Dam was built on the Sandusky River between 1911 and 1913 in Ballville Township, approximately 1.5 miles (2.4 kilometers) upstream of the City and approximately 18 river miles (29 kilometers) upstream of Lake Erie (Figure 1-1). The dam is approximately 407 feet (124.1 meters) long and 34.4 feet (10.5 meters) high. It is composed of left and right spillways on either side of a non-overflow section. The right spillway, facing downstream, is 228 feet (69.5 meters) in length and has a crest elevation of 623.2 feet (189.9 meters) above sea level, the left spillway is 86.5 feet (26.4 meters) long and has a crest elevation of 624.2 feet (190.3 meters) above sea level, and the non-overflow is 92.5 feet (28.2 meters) long with a crest elevation of 633.8 feet (193.2 meters) above sea level. The non-overflow section has a penstock, six sluice gates, and a water intake. Additionally, a concrete sea wall, with a top width of 1.5 feet (0.5 meters) and top elevation of 636.7 feet (194.1 meters) above mean sea level, extends approximately 702 feet (214 meters) upstream from the left abutment.

The impounded section of the Sandusky River extends upstream from the dam approximately 2.1 miles (3.4 kilometers) and the surface area is approximately 89.3 acres (36.1 hectares) (ODNR 1981). Various private residences are located with views of the impoundment in several locations (Figure 1-1). The City's new raw water intake is located approximately 6,000 feet (1,828.8 meters) upstream of the dam and the new raw water reservoir is to the west of the intake. This reservoir became operational in February 2013. The upper extent of the impoundment is located near the Tindall Bridge where Rice Road crosses the Sandusky River.



Basemap: BING

Ballville Dam Location



Ballville Dam Project

0 1,000 2,000 Feet

Figure 1-1

The dam was originally built as a run-of-the-river hydroelectric generation facility by the Fremont Power and Light Company, which later became the Ohio Power Company. Run of the river designs provide limited water storage, while passing water freely over the dam in proportion to the quantity being delivered to the impoundment. This design functions to provide a constant pool for water withdrawal, not control of output. The dam was abandoned as a hydroelectric facility in the early 1900's because seasonal flow in the river was insufficient to meet power generating requirements of the plant. The company built a steam power plant to supplement the output of the hydroelectric plant in 1916. The steam power plant closed in 1929 but was reactivated briefly during World War II to supplement the region's power supply. The steam power plant was demolished in 1954.

The City bought the land and facilities in 1959 and re-purposed the dam to provide the City's water supply. Since the purchase of the Ballville Dam by the City in 1959, the impounded area has been used as a source of public water. In February 2008, the Ohio Environmental Protection Agency (OEPA) issued a Findings and Orders notification to the City citing numerous Ohio Administrative Code (OAC) Rule violations related to the operation of the Public Water System (PWS) and water quality of the City's PWS (OEPA 2008). Among the violations were elevated nitrate levels[1] documented from samples taken over a period from June 1999 to June 2007. Within the Findings and Orders, the OEPA ordered the City to prepare plans for construction of an off-stream reservoir that would hold approximately 730 million gallons of raw water to address the nitrate violations. A schedule was also provided for completion of construction plans and start of operation of the water supply (OEPA 2008). In August 2011, the OEPA revised the original Findings and Orders to include violations of the previously agreed-upon schedule. The new Findings and Orders provided a new schedule based upon the expected date of operation for the raw water reservoir system (OEPA 2011b). This document also noted continued nitrate level violations during the periods of 2009 and 2010. The reservoir became operational in February 2013. As of fall 2013, the new raw water reservoir is the primary source of water for the City of Fremont and has an available water capacity of 730 million gallons. Based on its design specifications, the Ballville Dam and the impounded area are no longer necessary as a PWS for the City.

On April 22, 2011, Ballville Hydroelectric Group, LLC filed an application with the Federal Energy Regulatory Commission (FERC), pursuant to section 4(f) of the Federal Power Act, proposing to study the feasibility of the Ballville Dam Hydroelectric Project No. 14153, to be located at the existing Ballville Dam on the Sandusky River, in the City of Fremont, in Sandusky County, Ohio. A preliminary permit was awarded to the Ballville Hydroelectric Group, LLC by FERC in August 2011. This preliminary permit was issued for a period effective from August 1, 2011 and ending either 36 months from the effective date or on the date that a development application is accepted for filing, whichever occurs first (FERC 2011).

[1] OAC Rule 3745-81-11(A) states that the maximum contaminate level for nitrate for all Public Water Systems (PWSs) is 10 milligrams per liter.

Progressive deterioration of the dam and associated sea wall has been noted in successive inspections beginning in 1980, however the last known maintenance performed on the structure occurred in 1969 (ODNR 1981; ODNR 1999; ODNR 2003; ARCADIS 2005). The ODNR informed the City in 2004 that if a remediation schedule for the dam was not submitted and approved by December 1, 2007 legal enforcement actions could result. In August 2007, the ODNR issued a Notice of Violation (NOV) to the City stating that, as a result of its poor condition, the dam was being operated in violation of the law. In June 2011, the ODNR extended timeframes for bringing the dam into compliance (ODNR 2011b) in recognition that a new PWS reservoir was being completed. This letter noted that extension of the schedule for compliance did not remedy concerns regarding the condition of the dam.

1.3.2 Ballville Dam Inspections and Analyses

The Ballville Dam has been subject to multiple inspections and analyses since 1980. In 1980, the Ohio Department of Natural Resources (ODNR) Division of Water performed a Phase I inspection of the dam for the USACE Pittsburgh office. No structural or hydraulic problems of significance were observed during visual inspections (ODNR 1981). This report recommended four areas where further investigation was needed. Those areas were:

1. Evaluations by a structural dam engineer should occur for the right overflow toe, the foundation at noted eroded areas along the entire toe of the dam, stability of the dam and sea wall for the Probable Maximum Flood (PMF), erosion characteristics of the channel rock downstream of the dam, and the left abutment wall foundation related to erosion and deterioration.

2. Repair surface locations where deterioration has occurred.

3. Periodic visual inspection and monitoring of seepage areas.

4. Implementation of standard operation and maintenance procedures.

A stability analysis of the dam was performed by Dodson-Lindblom Associates, Inc. (1984). Plans for stabilizing the sea wall were prepared in 1987 by Feller, Finch, & Associates, Inc. However, these plans were not implemented.

The ODNR inspected the dam in 1998 and 2003. The 2003 inspection report (dated 2004) found that concrete conditions observed in 1998 were continuing to deteriorate (ARCADIS 2005). Three areas requiring attention and action from the City were identified: 1.) repairs and investigations, 2.) maintenance and operation, and 3.) monitoring. These items were not different from what the 1981 inspection report found, however, specifications of maintenance were provided regarding the “lake drain,” or sluice gate. The City was given until December 2007 to meet the required remedial measure identified in the report including implementation of any developed construction plans. However, no remedial actions have occurred.

Results from an investigation by ARCADIS FPS, Inc. (ARCADIS) were provided in 2005 to the City in response to the inspection report from ODNR prepared in 2004. Their report provided details from investigating the dam and sea wall including the ability to safely pass the Probable Maximum Flood (PMF) and the deterioration of the concrete structures. The report concluded that:

- The dam could not safely pass the PMF;
- The spillway and central sections have adequate stability for all loading conditions including the PMF;
- The sea wall could be unstable for floods greater than the top of the sea wall (>50,000 cubic feet per second);
- Routine maintenance, e.g. vegetation removal, should be performed; and
- The deterioration of the concrete did not endanger the stability of the structures.

The report recommended the following remediation measures be undertaken to address concerns from ODNR and USACE regarding the dam safety. Specifically, ARCADIS recommended the following:

- the sea wall should be stabilized using one of two methods: 1.) gravity stabilization with grouted riprap on uphill side, or 2.) post-tensioned anchors through the wall and into bedrock;
- the concrete on the dam be repaired by removing the deficient concrete, preparation of the surface, placement of reinforced concrete, shotcrete and/or epoxy on structures and in bedrock scour voids; and
- Steel guards installed on certain structure corners.

The ODNR prepared a Dam Safety Inspection Report for the Ballville Dam on September 24, 2013 (ODNR 2013a). This report found the conditions recorded in prior inspection reports to have worsened over time. Required remedial measures presented in the inspection report include:

1. Engineer Repairs and Investigations

    a. Provide ODNR with written verification of the operation of all lake drains and intake valve. These drains and intake valve need to be repaired or abandoned.

    b. Preparation of plans and specifications to increase the discharge/storage capacity and stability of the seawall to safely pass the required design flood. In accordance with Ohio Administrative Code Rule 1501:21-13-02, the minimum design flood for Class I dams is 100% of the PMF.

    c. Preparation of plans and specifications for correction of concrete problems. Current conditions must be monitored for further deterioration until repairs are made.

2. Owner Repairs

    a. Removal of trees and brush within 20 feet of seawall and wing walls at the downstream abutments and stabilization of disturbance areas.

    b. Installation of staff gauge on the structure, with extension below normal pool, for monitoring flows.

3. Owner Dam Safety Program

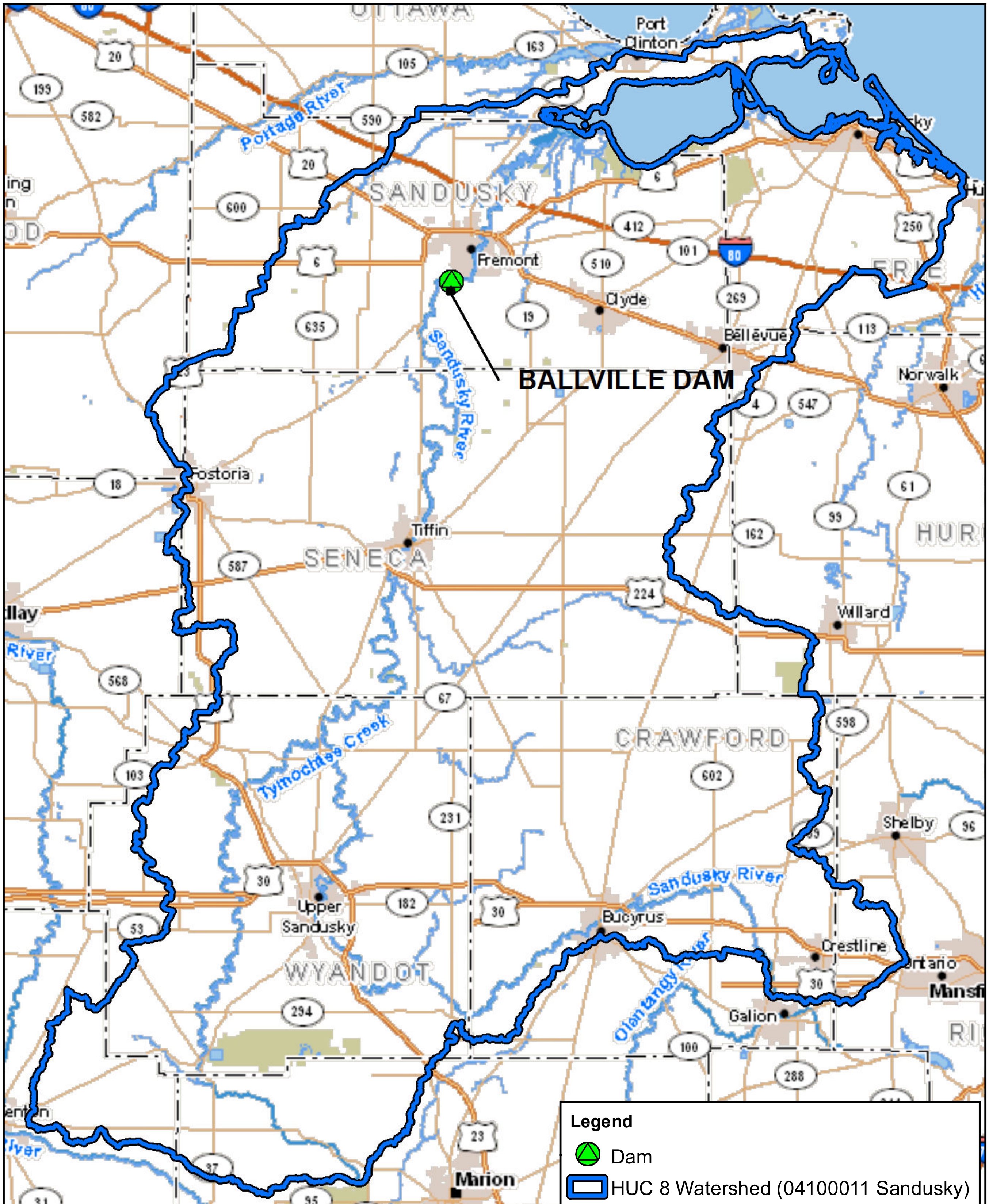
    a. Development of an operation , maintenance, and inspection manual in accordance with Ohio Administrative Code Rule 1501:21-15-06 that includes weekly monitoring of deteriorating concrete and applicable photographs for documentation of inspection.

    b. Monitoring of leakage from the penstock monthly for increase in flow. Should flow change rapidly, an Emergency Action Plan should be invoked.

The September 2013 remedial measures are a continuation and addition to those measures identified in previous dam safety inspection reports.

1.3.3 The Sandusky River Ecosystem

The Sandusky River is one of Ohio's largest tributaries to Lake Erie, about 130.5 miles (210kilometers) in length with a watershed encompassing 1,420.9 square miles (3,680 square kilometers) that drains into the 36,304.7 acre (14,692 hectare), estuarine-like, Sandusky Bay before entering the lake proper (Figure 1-2). In 1970 approximately 70 miles (112.7 kilometers) of the Sandusky River was designated as the state of Ohio's second scenic river. Designation starts upstream at the Route 30 Bridge in Upper Sandusky and extends to the Roger Young Memorial Park in Fremont, and includes the portion of the river within the project area. The geology of the basin is dominated by unconsolidated glacial deposits overlying limestone, dolomite, sandstone, and shale bedrock. Most of the soils are formed from glacial parent material and are fertile with high clay content. Agriculture is the predominant land use (84%) and water quality problems arise from agricultural runoff (nutrients, agricultural chemicals, and increased suspended sediment loads). River connectivity is disrupted by a low-head dam near the City of Tiffin, Ohio (39.8 river miles [64 river kilometers] from Sandusky Bay) and by the Ballville Dam near the City of Fremont (19 river miles [29 river kilometers] from Sandusky Bay).



Basemap:
OGRIP

Sandusky River Watershed

N
W E
S

Ballville Dam Project

0 2.5 5 Miles

Figure 1-2

Together, the Sandusky River and Bay system provide important habitat for a variety of flora and fauna in both upland and wetland areas. Waterfowl and other migratory birds depend on this system for breeding and migration habitat. A diverse fish community of 88 native species use the river and bay system for some or all of their life stages, including Walleye (*Sander vitreus*), White Bass (*Morone chrysops*), Channel Catfish (*Ictalurus punctatus*), Smallmouth Bass (*Micropterus dolomieu*), Redhorse Suckers (*Moxostoma spp.*), Buffalo (*Ictiobus spp.*), and Northern Pike (*Esox lucius*) (Bogue 2000). The Greater Redhorse (*M. valenciennesi*) is a state-threatened species that continues to be observed in the river (ODNR, unpublished data). Walleye and White Bass support significant spring river fisheries in the Sandusky River, providing about ~196,000 angler hours during March-April fisheries in 2009, while ranging from approximately 102,000 to approximately 367,000 hours annually since 1975 (Table 4.2.1 ODNR 2010).

Other species support relatively small fisheries on their largely residential (non-migratory) river populations but play important ecological roles in the fish community. Dam removal would increase fish access to habitat by nearly 2-fold in terms of river length (18 miles [29 km] below dam, 21.7 miles [35 km] above dam to next dam) and about 15-fold in terms of gravel-cobble areas (approximately 19.8 acres [8 hectares] below dam, approximately 301.5 acres [122 hectares] above dam). An improved river flow regime with open access to substantially more habitat should increase the abundance of virtually all species, and likely species diversity as well, when compared to present conditions both above and below Ballville Dam.

The importance of restoring Sandusky River habitat is addressed in a formal state management plan of the ODNR, e.g., the Sandusky River Basin Fisheries Tactical Plan (Davies and Tyson 2001). The authors of the plan indicate that “dams alter the connectivity, hydrology, and water quality characteristics of stream flow. Dams with sediment trapping capacity in their reservoir (such as the Ballville) tend to increase available energy for stream scour and channel incision downstream. The management objective is to re-establish stream flow conditions in the Sandusky River to mimic natural flow regimes and conveyance in channels.” They further add that “removal of the Ballville Dam is a cornerstone in the rehabilitation of aquatic habitats in the Sandusky Hydrological unit,” which includes the Sandusky River and Sandusky Bay. Restoration of hydrological connectivity and fish passage in major Lake Erie tributaries is also identified in the ODNR Division of Wildlife’s Strategic Plan (ODNR 2011c), and the Lake Erie Tactical Plan (ODNR 2013c), which directs management authorities when possible to identify, protect, and restore lost or critical habitat in the watershed and minimize impacts to Lake Erie.

1.3.4 Impact of the Ballville Dam on Aquatic Resources

Water bodies within the State of Ohio have, by law, designated beneficial uses that are protected by water quality standards. Within the project area, the Sandusky River’s Aquatic Life Use Standard is Warm Water Habitat (WWH). The Sandusky River has also been designated for Public Water Supply, Agricultural Water Supply, Industrial Water Supply, and Primary Contact Recreation. The Sandusky River was sampled at five locations between river mile

(RM) 5.5 and 18.05 in 2009. The Sandusky River at the Ballville Dam (RM 18.05) was found to be in non-attainment of the WWH designation due to siltation and direct habitat alteration.

Ballville Dam divides the aquatic ecology of the lower Sandusky River, altering biological functions and impacting both riparian and aquatic habitats otherwise provided by a historically connected Sandusky River watershed. One major ecological impact is that the Ballville Dam represents an impassable barrier to upstream movement of all aquatic organisms and to downstream movement of many aquatic organisms. Ballville Dam has an impact on habitat accessibility, habitat conditions, and the overall ecology of its impounded area and the downstream reaches for all species which utilize those areas. This includes year round resident species, as well as migratory species moving into the system during spawning life stages. Included on the list of impacted species are freshwater mussels as well as sport and non-sport fish species such as Greater Redhorse, Walleye, and White Bass. A portion of this impact was noted historically by Trautman (1975), stating that "…the Lake Erie tributaries, with their spawning and nursery areas, formerly contributed greatly to the huge populations of some species of fishes in the lake. As was also recorded from the Maumee River many fish species migrated into and spawned in the Sandusky River before the event of dams, extensive drainage, increased turbidity, and other pollutants." Trautman (1975) further comments that "…more than half of the 88 fish species recorded for the Sandusky River have decreased in numerical abundance since 1850 or have been extirpated. These include species prevented from migrating upstream to spawn because of dams; those whose spawning habitat has been largely destroyed by agricultural practices, ditching and draining; those who require considerable aquatic vegetation; and/or those intolerant to turbidity. Many species of former economic importance, such as Sturgeon, Muskellunge and Walleye, have been largely or entirely eliminated."

The Sandusky River is a tributary to Lake Erie and provides important habitat for many aquatic species. Numerous species of fish and mussels utilize the Sandusky River for a variety of life stages, including spawning, prey resources, and predator evasion. One example of this is White Bass, which utilize river habitat to reproduce. Current otolith microchemical research suggests that as much as 80 percent of young of year White Bass captured in the central basin of Lake Erie appear to have been spawned in or near the Sandusky River (Jeremiah Davis, Communication; Bowling Green State University). Another example of the species that rely on this resource is the Sandusky River Walleye stock, or sub-population.

Walleye are a highly migratory species in the region, moving throughout all three basins of Lake Erie and northward into Lake St Clair and Lake Huron (Wang et al. 2007). The Sandusky River Walleye stock is recognized by fisheries managers as one of several discrete Walleye stocks that contribute to inter-jurisdictional fisheries in the U.S. and Canada (Bigrigg 2008). Although current migratory Walleye and White Bass stocks that spawn in the Sandusky River support a smaller percentage of the fisheries in the river and in Lake Erie, it is thought that increases in their abundance would lead to commensurate economic benefits at local, state, and inter-jurisdictional scales. ODNR research indicates that the Sandusky River Walleye stock is constrained by the amount (approximately 19.8 acres [8 hectares]) of spawning habitat below the dam, and that this extant habitat is likely deteriorating from a lack of gravel replenishment (Davies 1994; Plott 2000). Their research also indicates that approximately 301.5 acres [122 hectares] of suitable spawning habitat exists upstream of the dam, and that, when relocated to that location, Walleye can spawn and produce larvae from the upstream habitat (Davies 1994; Plott 2000; Jones et al. 2003; Cheng et al. 2006, McMahon et al. 1984). However, data from surveys completed in 2009 and 2010 did not capture any Walleye (Ross 2013). While this research may not guarantee that the Sandusky River Walleye stock would immediately find and use new habitat, it does support the premise that the major impediment to Walleye reproduction in this system, lack of spawning habitat, would be addressed in part through dam removal (Plott 2000; Thompson 2009).

Similar to Walleye, the expansion of available habitat would benefit many other species of fish such as the White Bass which utilize the Sandusky River for at least a portion of their life history. Surveys completed by Ross (2013) did not capture White Bass upstream of the Ballville Dam in 2009 and 2010. Habitat expansion may assist in returning this and other native species to the upstream reaches of the river which have been absent for many years.

Additionally, the Ballville Dam has altered natural hydrologic and sediment transport functions in the Sandusky River. Notably the dam currently traps coarse sediment in the upper portion of the impoundment as water velocities are reduced and they are no longer carried by stream flows. In an unobstructed system these coarse materials would naturally be transported downstream (ODNR 2010). The supply of such coarse sediments is necessary for replenishing and maintaining downstream spawning habitat, which is important for many native aquatic species utilizing these areas during a series of life stages. Alternatively, few clays or fine sediments are trapped by the dam and are instead transported over the structure within the water column to habitats downstream. The restriction of coarse sediments, while conveying fine sediment downstream, can negatively impact important habitats, including spawning areas, by filling in interstitial spaces likely leading to a more homogeneous benthic environment (Plott 2000; Poff and Hart 2002).

1.4 DECISION REQUIRED

Upon the completion of the NEPA process, including a 30-day public comment period on the FEIS, the Service Region 3 Regional Director at Bloomington, MN will consider whether the facts and analyses provided herein support the issuance of federal funding in support of the Preferred Alternative. A concise Record of Decision (ROD) will then be issued detailing consideration of the environmental analysis for the project in accordance with NEPA.

In addition to the decision required by the Service, the USACE will also require a decision on the issuance of Section 404 and Section 10 permits.

1.5 PURPOSE FOR THE FEDERAL ACTION

The purposes for the issuance of federal funds and preparation of this FEIS are to restore natural hydrological processes over a 40 mile (64.4 kilometer) stretch of the Sandusky River, re-open fish passage to 22 miles (35.4 kilometers) of new habitat, restore flow conditions for fish access to new habitat above the impoundment, and improve overall conditions for native fish communities in the Sandusky River system both upstream and downstream of the Ballville Dam, restoring self-sustaining fish resources. These actions would support the goals of the Act and the GLRI. The Service has ensured compliance with NEPA and other applicable Federal laws and regulations in order to satisfy project planning obligations for federal funding.

1.6 NEED FOR THE FEDERAL ACTION

Issuance of federal funds address the following needs related to the current conditions of the Sandusky River:

- Restore and expand upon self-sustaining fishery resources within the lower Sandusky River by providing fish passage in the Sandusky River at the Ballville Dam impoundment site in both the upstream and downstream directions.

- Restore system connectivity and natural hydrologic processes between the impounded area upstream of Ballville Dam and the lower Sandusky River, which would restore riverine fish and wildlife habitat, resulting in a net gain in the amount of free-flowing riverine habitat.

Meeting the needs listed above would likely address conditions or objectives of agreements currently in place between the City and other local, state, and federal agencies. Those may include, but are not limited to:

- Eliminating flood risks to the City of Fremont.

- Eliminating liabilities associated with the current safety conditions of the Ballville Dam including potential threats to private properties both upstream and downstream of Ballville Dam.

- Managing downstream movement of stored impoundment sediments.

- Achieving Aquatic Life Habitat Use-Attainment (as defined by OEPA in §3745-1-07 of Ohio Administrative Code) for the lower Sandusky River.

- Improving and increasing aquatic habitat availability in the lower Sandusky River downstream of the Ballville Dam site.

The FEIS evaluates and considers impacts to the human environment that are expected to occur as a result of federal funding for this project.

1.7 REGULATORY AUTHORITIES

The Project is subject to a combination of federal, state, and local regulations aimed to protect human health and the environment. This FEIS has been prepared in accordance with NEPA. This and other regulatory authorities are summarized in the Table 1-1 below.

Table 1-1. Authorizations Required for Ballville Dam Project and Restoration Activities

Agency	Authority and Requirement	Activity Covered
Service (Lead Agency)	Section 7 of the ESA	Requires intra-Service consultation if the proposed action is likely to adversely affect a federally listed endangered or threatened species.
	National Environmental Policy Act	Requires the Federal agencies to incorporate environmental considerations into their planning processes.
	Migratory Bird Treaty Act	Regulates most aspects of the taking, possession, transportation, sale, purchase, barter, exportation, and importation of migratory birds.
	Bald and Golden Eagle Protection Act	Prohibits the take, possession, sale, purchase, barter, offer to sell, purchase or barter, transport, export or import, any bald eagle alive or dead, or any part, nest, or egg.
	Great Lakes Fish and Wildlife Restoration Act	Provides funding and cooperation for restoration projects within the Great Lakes watershed.
	Section 106 National Historic Preservation Act	Requires Federal agencies to identify historic properties potentially affected by undertakings, and to seek ways to avoid, minimize, or mitigate any adverse effect on these properties.
ODNR	Scenic Rivers	Requires Federal, state, and local political subdivision to obtain approval of any plans to build or enlarge any highway, road, or structure or modify or cause the modification of the channel of any watercourse within a wild, scenic, or recreational river area outside the limits of a municipal corporation from the director or natural resources.

Table 1-1. Authorizations Required for Ballville Dam Project and Restoration Activities

Agency	Authority and Requirement	Activity Covered
USACE	Section 404 of the Clean Water Act (CWA)	Regulates the discharge of dredged or fill material into waters of the United States, including wetlands
	Section 10 Rivers and Harbors Act	Section 10 of the Rivers and Harbors Act (33 U.S.C. 401 *et seq.*) requires authorization from USACE for the construction of any structure in or over any navigable water of the United States, the excavation/dredging or deposition of material in these water or any obstruction or alteration in a "navigable water".
OEPA	Section 401 of the CWA	Certify that a federally issued Section 404 CWA permit will not result in a violation of state water quality standards
	National Pollutant Discharge Elimination System (NPDES)	Requires a permit for all facilities discharging pollutants from a point source to a water of the state.
	SWPPP	As outlined in the Ohio Revised Code (§1511.02) this program develops standards and practices to prevent pollution, reduce stormwater impacts and conserve soil during and after development.
FEMA	Floodplain Management	Compliance with the National Flood Insurance Program and State Floodplain regulations.
EPA	Executive Order 11990 – Protection of Wetlands	Federal agencies must avoid causing adverse impacts associated with the destruction or modification of wetlands.
Ohio Department of Transportation	ORC Chapter 5577.04, 05	A permit is required to move oversized and/or overweight loads along or across state roads.

2.0 EIS Scoping, Identification of Alternatives, and Public Consultation

This chapter describes the public and agency involvement process used to develop the scope of, and identify the major issues to be discussed within the FEIS. Further, it describes alternatives that were developed to meet the purpose and need of the project to restore fish passage, system connectivity and natural hydrologic processes in the lower Sandusky River. It explains how and why these alternatives were selected for detailed study, describes how public input was used in the alternatives development process, and discusses why some alternatives were determined to be infeasible or inconsistent with the purpose and need, and therefore were not analyzed in detail.

2.1 SCOPING PROCESS

2.1.1 Scoping Requirements

NEPA (40 C.F.R. 1501) and Service guidelines (550 FW 2.3) specifically define the need for a public scoping process when preparing an EIS. The scoping process is an open public process initiated prior to the preparation of an EIS to define a reasonable scope for and reduce the magnitude of an EIS. In particular, the public scoping process should:

1) Identify and invite the participation of affected agencies, tribes, and other parties through written comments, public meetings, or other forums;
2) Identify the key issues and concerns regarding the Proposed Action;
3) Identify only those potentially significant issues relevant to the Proposed Action (while eliminating unimportant issues from further study); and
4) Define the form, level of detail, and content of the EIS.

Scoping typically begins with publication in the Federal Register of a notice of intent (NOI) to prepare an EIS. Formal scoping began for the NEPA analysis on October 21, 2011 when the Notice of Intent (NOI) to prepare a DEIS was published in the Federal Register (76 Fed. Reg. 65526-65527). The NOI described the project background, requested public comment, and announced a public meeting. On October 27, 2011, a public scoping meeting was held in Fremont, Ohio to provide the public with an opportunity to present comments, ask questions, and discuss issues with Service staff regarding the DEIS. In addition, written comments were submitted by members of the public.

2.1.2 Issues Identified During Scoping

Many concerns were raised during the Federal scoping process. Some concerns included: the uncertainty of impacts; the implications of project-related sediment disposition; the impact of dam removal on related occurrences such as ice jam flooding; and the historical nature of the structure and its importance to the local community.

The public's comments were used to develop the issues and concerns listed below, as well as other environmental impacts identified during project development. The issues were used to drive the analysis and were important in the development of the alternatives. In no particular order, these issues include the following:

- Cultural Issue: The dam and surrounding area have cultural importance to the residents of the area, and contribute to a sense-of-place.
- Sediment Issue: How much sediment is trapped behind the dam? What will happen to the sediment that is currently held in place by the dam, once the dam is removed? How will the transported sediment load impact downstream land owners and Sandusky Bay?
- Flooding Issue: Would dam removal increase flooding susceptibility of the area?
- Ice Jam Issue: How will ice jams be controlled after the dam is removed (as they are currently controlled, in part, by the dam structure)?
- Water Quality and Fisheries Issues: How will water quality and fisheries be improved by dam removal?
- City Water Issue: What will be the future impact on water availability for the City?
- Structural Retention Concerns:
    - For hydropower: Could the dam remain in place and be used to generate hydroelectric power?
    - For flood control: Could the dam sluice gates be opened and used for flood control?

Along with those listed above, many other issues and concerns were brought up and considered throughout scoping and the development of the FEIS, including the existence of an agreement between the City and the ODNR which awarded $5 million to the City to assist in construction of the off channel water supply reservoir and stipulated the removal of Ballville Dam.

2.2 ALTERNATIVES DEVELOPMENT

During the public scoping period, the public was asked to provide written comments regarding the proposed project (i.e. removal of the dam). Public comments were used to help develop alternatives, or aspects of alternatives. Following public scoping, the Service reviewed the purpose and need statement, public scoping comments, and previous studies in their initial effort to develop conceptual alternatives.

An initial list of ten conceptual alternatives was developed. Alternatives were screened out after brief evaluation based on concept constructability, functionality, estimated costs, and/or potential for success. Provisions in NEPA require that alternatives meet (or meet most of) the purpose and need, and be technologically and economically feasible. The alternatives that were carried forward for more detailed analysis in the FEIS were those that best meet the purpose and need, minimized adverse effects to the human environment, were economically and technologically feasible, and represent a range of reasonable alternatives. Some alternatives did not fully meet the purpose and need, but they had potential to minimize some types of effects to the human environment or help create a reasonable range of alternatives for consideration by decision-makers. Table 2-1 presents a summary of conceptual alternatives considered. The draft alternatives were also provided to the cooperating agencies for their review and comment prior to finalization.

Table 2-1. Summary of Conceptual Alternatives Considered by Number/Name

Alternative Number	Alternative Name	Description	Results
Alternative 1	No Action	Implement none of the action alternatives; Most likely action would be for the City to rehabilitate the structure.	Alternative 1 moved forward in FEIS for further review as a requirement under NEPA.
Alternative 2	Rehabilitate Dam, Install Fish Passage Structure	Bring Ballville Dam up to safety standards; construct fish elevator structure.	While Alternative 2 does not fully meet the purpose and need, it is carried forward because it meets a portion while eliminating the release of sediments. Consideration of this alternative would give a reasonable range of alternatives to inform decision-makers.

Table 2-1. Summary of Conceptual Alternatives Considered by Number/Name

Alternative Number	Alternative Name	Description	Results
Alternative 3	Dam Removal with installation of ice control structure	Remove Ballville Dam in one season while constructing ice control and allowing for: fish passage; system connectivity; elimination of liability of maintaining dam structure.	Alternative 3 carried forward in FEIS because it meets the purpose and need.
Alternative 4	Incremental Dam Removal with installation of ice control structure	Remove Ballville Dam over several seasons allowing for: fish passage; system connectivity; elimination of liabilities of maintaining dam structure.	Alternative 4 carried forward in FEIS because it meets the purpose and need.
Alternative 5	Dam Removal without installation of ice management system	Remove Ballville Dam without incorporating ice control; allowing for: fish passage; system connectivity; elimination of liability of maintaining dam structure.	Alternative 5 was not carried forward in FEIS because, based on best available information, this may functionally place the City in at a heightened risk of ice flooding.
Alternative 6	Dam Removal with active river ice management	Remove Ballville Dam with incorporating active river ice management; allowing for: fish passage; system connectivity; elimination of liability of maintaining dam structure.	Alternative 6 was not carried forward in FEIS because this may functionally place the City at a heightened risk of ice flooding and is economically infeasible.
Alternative 7	Rehabilitate dam, Hydroelectric Generation	Bring Ballville Dam up to safety standards; renovate to provide hydroelectricity.	Alternative 7 was not carried forward in the FEIS because it does not meet the purpose and need.

Table 2-1. Summary of Conceptual Alternatives Considered by Number/Name

Alternative Number	Alternative Name	Description	Results
Alternative 8	Rehabilitate Dam, use as Flood Control Structure	Bring Ballville Dam up to safety standards; Dredge the impoundment; Rehabilitate Dam to provide full operation of existing gates.	Alternative 8 was not carried forward in the FEIS because it does not meet the purpose.
Alternative 9	Dam Removal with Impoundment Dredging	Dredge Sediments in Impoundment Prior to Dam Removal	Alternative 9 was not carried forward in the FEIS because it is cost prohibitive
Alternative 10	Rehabilitate Dam, Reconfigure Gates for fish passage	Bring Ballville Dam up to safety standards; remove gates and penstock to substrate allowing it to function as a conduit that allows for fish passage and water discharge under the dam.	Alternative 10 was not carried forward in the FEIS because it is not considered technically and economically feasible.
Alternative 11	Rehabilitate Dam, Fish Stocking, Catch and Release	Bring Ballville Dam up to safety standards; stock the upper reach of the river as well as catch and release downstream fishes.	Alternative 11 was not carried forward in the FEIS because it does not fully meet the purpose and need and is not feasible as a long term ecological solution.

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER EVALUATION

Several of the conceptual alternatives were removed from further consideration primarily due to infeasibility and/or meeting only portions of the purpose and need while not substantively reducing environmental effects of the dam. These alternatives include the Dam Removal without Ice Management System (Alternative 5), Dam Removal with Active River Ice Management (Alternative 6), Hydroelectric Generation (Alternative 7), Flood Control Structure (Alternative 8), Dam Removal with Impoundment Dredging (Alternative 9), Reconfiguration of Dam – Removal of Sluice Gates (Alternative 10), and Stocking, Catch and Release (Alternative

11). Although the No Action Alternative does not meet the project purpose and need, it is retained through the FEIS analysis as required by NEPA regulation as the baseline condition against which the potential impacts of action alternatives are measured. The following sections describe these alternatives (5-10) and briefly summarize why they were eliminated from further analysis.

2.3.1 Dam Removal without Installation of an Ice Management System

A report was completed by the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) detailing the formation and impacts associated with ice jams on the lower Sandusky River near the City of Fremont. The CRREL report (USACE 2008) indicated that:

“Based on this analysis, the Ballville Dam has had an impact on reducing damaging ice jams in Fremont, Ohio. Further investigation of the removal of the Ballville Dam on the formation of ice jams in the Sandusky River is recommended. The investigations should focus on the risk of flooding and ice damage to bridges and floodwalls caused by the additional ice carried from upstream of the current dam location to downtown Fremont. The two major alternatives for controlling ice in the absence of the Ballville Dam are described: ice piers and active river ice management (USACE 2008).”

The CRREL (USACE 2008) used the ice routine within the Hydrologic Engineering Centers River Analysis System (HEC-RAS) to model current and dam-removed conditions. Twenty-eight ice jam events from 81 years of data were utilized to calibrate the model. The results indicate that the removal of the dam would have an impact on ice jam processes in the vicinity of Fremont. Winter flood levels would likely be increased in the downtown area as the portion of ice previously held by the dam would be added to the jam experienced north of the City. Stages downtown rose as much as 10.5 feet (3.2 meters) and increased on average from 3.5 to 7.0 feet (1.1 to 2.1 meters) over the range of return periods used in the analysis. The floodwalls were high enough to protect the City from a majority of events under a 100 year flood event.

Further investigation by the CRREL in 2011 (USACE 2011a) concluded that “Based on this analysis, the removal of Ballville Dam will likely increase flood levels in Fremont, due to larger available ice volumes no longer retained by the dam. An ICS structure is recommended to retain that larger ice volume.”

Based on the 2008 report and follow up investigations in 2011, it would be irresponsible to carry this concept forward and consider an alternative that does not account for the potential heightened risk of ice flooding to the citizens of Fremont.

2.3.2 Dam Removal with an Active River Ice Management Plan

USACE (2008) discusses the frequency and potential alternatives to mitigate ice jams if Ballville Dam is removed. One option discussed in that report is to “Institute active river ice monitoring and ice management strategies. Ice formation in the reach downstream of Fremont to Sandusky Bay would be monitored during the winter months. Active measures would be applied to reduce the ice strength and/or melt the ice in place, reducing the potential for damaging ice jams. These measures include hole drilling, ice cutting and darkening the ice surface (Haehnel 1998)."

Based on the USACE (2008) analysis, the use of a system like this can be difficult to implement effectively due to the timing of ice floods and the potential variability in conditions. The report notes that "Active measures generally provide less protection than permanent structures." The report indicates that active monitoring of the river's ice conditions would be necessary by means of web-based cameras, satellite remote sensing, or similar application. Monitoring could be linked up to a break-up ice warning system that could be installed in the ice and set to provide an alarm when ice motion is detected. This would require intense assessment of each potential ice damming event. Timing would be paramount for effectiveness of this strategy.

Although, active river ice management could be an effective tool to protect the City from ice related flooding, practicality and costs make it infeasible (USACE 2008). Additionally, this system would create a heightened risk of flooding to the City compared to an ICS structure or maintaining the dam in place because of the sometimes unpredictable weather and river patterns leading to ice formation and breakdown. Therefore, this alternative was not carried forward in the FEIS.

2.3.3 Hydroelectric Generation

Hydroelectric generation, by itself, does not meet any of the aspects of the purpose and need for the project. The purposes for the issuance of federal funds and preparation of this FEIS are to restore natural hydrological processes, re-open fish passage, restore flow conditions, and improve overall conditions for native fish communities in the Sandusky River system, restoring self-sustaining fish resources. Hydroelectric generation is not addressed in these purposes. The needs of fish passage, restoration of system connectivity and natural hydrologic processes would not be met. Additionally, liabilities and financial responsibilities associated with maintaining the structure would remain. Hydroelectric generation coupled with fish stocking, capture and release, or a fish passage structure could provide for artificial movement of fish upstream of the existing Ballville Dam, but it does not meet the need for restoring system connectivity and natural hydrologic processes in the lower Sandusky River. However, it should be noted that the two alternatives described in Chapter 3 which would retain Ballville Dam, the No Action Alternative and the Fish Passage Structure Alternative, do not necessarily preclude the future addition of hydroelectric power.

The placement of hydroelectric generation as an alternative to dam removal does not meet the purpose and need for this project and it is therefore outside the scope of this document to fully analyze this alternative.

2.3.4 Flood Control Structure

Comments received during the public comment period suggested using the dam as a flood control structure. Coupled with active sediment dredging in the impoundment this alternative would seek to reduce sediment loads in the Sandusky River and deposition in Sandusky Bay in an attempt to benefit Walleye populations in the lower Sandusky system by maintaining flow through the sluice gates currently installed in the structure and actively dredging the impoundment area on a recurring basis. As a precursor to managing Ballville Dam in this way, dredging would be planned to remove all sediments from the current impoundment to maximize water storage capacity.

The Ballville Dam was originally designed to function as a run-of-the-river (ROR) hydroelectric generation facility. ROR refers to a specific dam design that provides limited water storage in its impoundment, while passing water freely over the dam in proportion to the quantity being delivered to the impoundment. The primary function of a ROR dam is to provide a constant pool for water withdrawal, not to control or manage water outputs.

Analysis of the Ballville Dam and impoundment indicate that for a major flood event, such as the 100 year flood occurrence, assuming the impoundment is devoid of water and sediments at the beginning of the event, the impoundment would be filled to capacity within one hour (Appendix A3). This estimate assumes all six sluice gates would be fully opened and operational, with each gate discharging at peak capacity in an effort to control the release. Once the impoundment is filled, discharge would continue via sluice gates and over the spillway, unmitigated, until the event passed. At that point in time, there would be no control mechanism to aid in flood abatement downstream. Given that the duration of peak flow during a 100 year flood occurrence would be expected to far exceed 1 hour, based on our analysis, the Ballville Dam and impoundment would provide insignificant flood management capacity, quickly filling and passing flood flows downstream.

Although the dam may provide some level of passive ice flooding protection as it currently is managed, using the dam to actively manage for flood control would not be feasible as the dam was not constructed to function in a flood control manner nor could it be repurposed to do so due to geographic limitations in the area (Appendix A3). This alternative would not meet the project purpose or address the need for restoring system connectivity and natural hydrologic processes in the lower Sandusky River, or eliminate liabilities associated with owning and maintaining the Ballville Dam. This alternative does not meet the purpose and need for the project; therefore, it is eliminated from further consideration.

2.3.5 Reconfiguration of Dam and Removal of Sluice Gates

A variety of dams have been constructed that allow for aquatic organisms to pass freely under the structure during some flow conditions. In southwest Ohio, a series of five earthen embankment dams allow for detention of water at high flows and discharge at a specific rate via concrete conduits. These dams, however, were constructed as flood control structures, requiring unique engineering and construction completely different in size and scope from the Ballville Dam.

During alternative development it was suggested that the sluice gates could be removed and conduit(s) could be placed to allow for fish passage, river connectivity and some natural hydrologic processes to occur. For this to be effective, Ballville Dam would have to have the needed flood storage capacity to effectively control large flood events as well as be structurally sound to allow for major modification at its base. It is expected that using the dam as a flood control structure would not be feasible as the dam was not constructed to function in a flood control manner nor could it be repurposed to do so due to geographic limitations in the area (Appendix A3). It also is noted that removing the sluice gates and a portion of the dam around them would likely cause a reduction in structural integrity, which could lead to unsafe conditions during a flood event.

After discussion and analysis looking at outflow, inflow, and storage estimates it was determined that in addition to a lack of flood storage capacity, concern regarding the advanced age of the structure, the current engineering design and method of structure anchoring, and the anticipated high financial costs for retrofitting would cause this alternative to not be feasible. While in theory it could meet portions of the purpose and need, practicality and costs prohibit its feasibility. Therefore, this alternative was not carried forward for further analysis.

2.3.6 Fish Stocking, Capture and Release

Fish species, primarily Walleye and other sport fish, could be captured and released above the Ballville Dam to those areas that are currently not available to downstream populations. This would require an intensive effort across a wide geographic area that would be repeated on an annual basis and also after large storm events. In 1997 and 1998, ODNR transported nearly 5,000 adult Walleye above the dam (Plott 2000). Post-release studies captured three spent females and 19 males upstream of the Ballville Dam. In addition, larval fish sampling conducted in the Ballville Impoundment, miles downstream of the release point, recovered a total of 90 larval Walleye, confirming that the spent fish were successfully spawning above the dam. However, the mortality of drifting larvae passing over the dam would presumably be very high. ODNR has evidence of adults surviving downstream movement over the dam, although anecdotally, Walleye have not been collected in subsequent fish surveys in the river upstream of the Ballville Dam (Ross 2013). Thus the prospect of establishing a resident non-migratory population upstream of the dam is improbable. Continuous stocking would be necessary in perpetuity with an expectation of limited larval survival rates and limited addition to the Sandusky Bay Walleye population. The same concerns exist when attempting to capture and stock other native species such as Greater Redhorse or White Bass.

While a fish stocking, capture and release alternative would provide for artificial movement of fish upstream of the existing Ballville Dam, it does not meet the purpose and need of the project for restoring system connectivity and natural hydrologic processes in the lower Sandusky River or eliminate liabilities associated with owning and maintaining the Ballville Dam. For many species, it also would result in high mortality rates of larval individuals as they move downstream over the dam, negating the potential benefits of increasing spawning habitat availability. Lastly, to provide continuous passage opportunities for a variety of species would require repeated collections and movements, peaking during migratory seasons. This alternative does not meet the purpose and need for the project; therefore, it is eliminated from further consideration.

2.3.7 Dam Removal with Impoundment Dredging

The disposition of sediment trapped by Ballville Dam since its construction in 1913 is paramount to understanding possible environmental impacts and the feasibility of dam removal alternatives. As such, it has been proposed through the cooperating agency group and through public scoping that the sediment be dredged out of the Ballville Dam impoundment prior to dam removal. This was suggested as a way to decrease potential environmental impacts of sediment movement downstream and also as a way to further reduce concern voiced during scoping regarding possible contamination of the impounded sediments. To investigate this alternative, we referred to previous studies completed by Stantec and others regarding the estimated quantity of sediment currently stored behind Ballville Dam, to work done to test the quality of the sediment in regards to contaminants, to investigate and model sediment release scenarios, and to analyze average sediment loading data in the Sandusky River. A detailed description of this information can be found in the Opinion and Probable Cost for Dredging the Ballville Dam Impoundment, Appendix A2. Another major component of this analysis which cannot be understated was the estimated cost associated with removing this sediment.

A cost table was created for a partial dredge option (200,000 cubic yards (CY) of sediment) and a full dredge option (800,000 CY). The probable cost including the hydraulic dredge, dewatering with geotextile, loading, hauling, and disposal is $26,153,895.00 for 200,000 CY, and $93,426,236.00 for 800,000 CY. In light of these costs, and the opinion of sediment quality by Evans and Gottgens (2007) as described in the FEIS Section 4.2.2.4.4, it was determined that dredging the impoundment was neither necessary nor economically feasible. While in theory this alternative could meet portions of the purpose and need, likely reducing some environmental impacts, practicality and costs prohibit its feasibility. Therefore, this alternative was not carried forward for further analysis.

2.4 PUBLIC AND AGENCY INVOLVEMENT

Members of the public, non-governmental organizations and governmental agencies all play an important role in project development. Public scoping for the EIS was first initiated in the form of an Notice of Intent (NOI) to conduct a 30-day scoping period for a NEPA decision on the proposed Ballville Dam project and request for comments, published in the Federal Register on October 21, 2011 (75 FR 4840-4842). A public scoping meeting was held in the City of Fremont on October 27, 2011 from 7:00pm to 9:00pm. The meeting included a presentation about the project as well as a question and answer session with members of the Service, ODNR, the City, and Stantec. The Service also conducted outreach by press releases and public notification to inform interested parties or those potentially affected by the Proposed Action and to request comments on the scope of the NEPA analysis. Comments were collected at that meeting, through U.S .mail, by phone, and through the email address Ballvilledam@fws.gov. Although the formal comment period ended November 21, 2011, comments continued to be received.

Public comments identified issues related to the Project. A total of 13 written or verbal comments were submitted during the scoping meeting and comment period identifying issues and concerns about the Proposed Action and the preparation of the DEIS. Comments were received via phone, voicemail, electronic mail, and hardcopy mail and are indexed and summarized in Appendix B. These comments were carefully reviewed and categorized into the issues that informed the analysis for the DEIS, as described in Sections 2.1 and 2.2.

Following the public scoping meeting, the Service sent invitations to potential "Cooperating Agencies" to formally provide input and direction into the project. Partners with a jurisdiction by law or by special expertise in the project were invited to sign a Memorandum of Understanding (MOU) with the Service officially naming them as "Cooperating Agencies" in the project (Appendix C). Those partners invited were the City of Fremont, USACE, ODNR, OEPA, and Ballville Township. Of those, the City, USACE, ODNR, and Ballville Township signed onto an MOU to assist in reviewing draft documents to ensure all parties have an opportunity to assist in project development, working towards the most complete and thorough analysis possible. The Service also sent consultation letters to the six tribal nations identified through the Native American Graves Protection and Repatriation Act (NAGPRA) database (http://grants.cr.nps.gov/nacd/index.cfm) to ensure they also had an opportunity to provide input and comment on the project.

During the FEIS development, the Service consulted with the Ohio Historic Preservation Office (OHPO) in conjunction with obligations to fulfill requirements under NEPA, Section 106 of the NHPA, and AIRFA (see Section 1.7 for a summary of these statutes and their regulations). The Service sent invitations to potential "Consulting Parties" to provide their input into the NHPA Section 106 components of the project. Partners with a jurisdiction by law or by special expertise in the project were invited. Those partners were the City of Fremont, USACE, ODNR, OEPA, and Ballville Township. The Service also invited two organizations identified as potential "Concurring Parties" to participate in the NHPA Section 106 process and provide their input. The organizations were the Sandusky County Historical Society, and the Rutherford B. Hayes Presidential Center. Both the Consulting and Concurring Parties, under these cultural statutes and regulations, were contacted by letter, follow-up phone calls, and emails. Personal meetings were conducted in order to provide information about the proposed Project and to seek additional input regarding the identification and evaluation of archaeological and historic resources. A Programmatic Agreement between the OHPO, Service, City of Fremont, USACE, ODNR, and OEPA was developed to address mitigation necessary to record the importance of the Ballville Dam and other historical features.

On January 24, 2014, the U.S. Environmental Protection Agency published the Notice of Availability of the DEIS in the Federal Register (FR 79 4158), opening a 60 day public comment period. A public meeting was held in Fremont on February 19, 2014, to provide information on the project, answer questions, and accept public comments.

During the comment period on the DEIS, comments were received from 29 individuals, organizations, and agencies, addressing a number of topics including impacts to wetlands, city water supply, ice control structures, sediment disposition, and other topics. The public comments and associated responses are available in Appendix B2 of this FEIS.

The Service will publish a Notice of Availability of the FEIS in the Federal Register, and will accept comments received or postmarked within 30 days of publication. The U.S. Fish and Wildlife Service's decision on issuance of Federal funding will occur no sooner than 30 days after the publication of the Environmental Protection Agency's notice of the FEIS in the Federal Register and will be documented in a Record of Decision.

The Service does not have a formal administrative appeal procedure for NEPA decisions. Judicial review of a Service NEPA decision can be accomplished in Federal court under the Administrative Procedure Act (5 U.S.C. §500 *et seq*).

3.0 Proposed Action and Alternatives

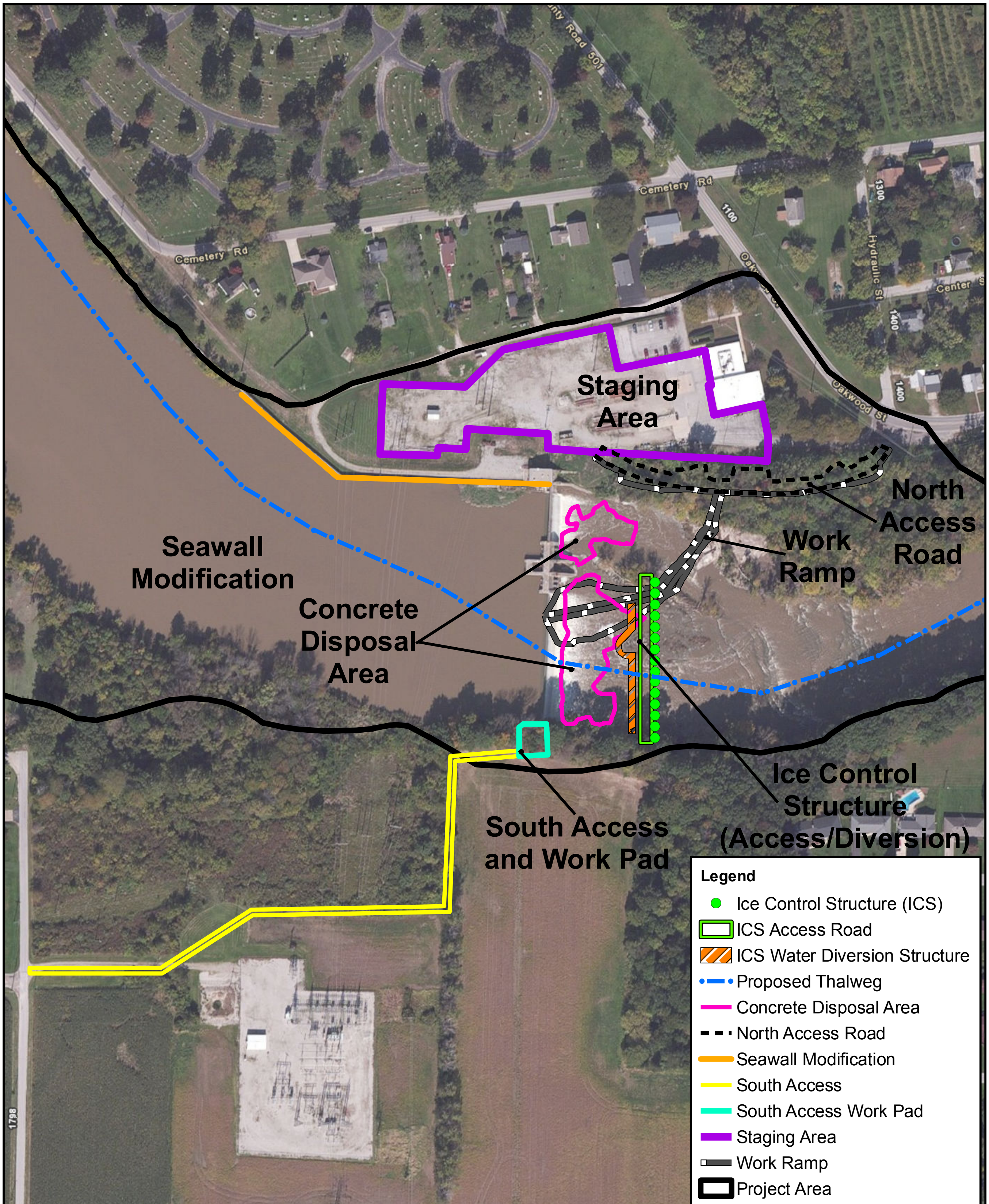
3.1 ALTERNATIVES CARRIED FORWARD FOR DETAILED EVALUATION

Four alternatives were carried forward for further evaluation including a No Action Alternative. The No Action Alternative is the measure against which the environmental impacts and other aspects of the action alternatives were compared. The alternatives to the Proposed Action were primarily designed to address the purpose and need of the project. These alternatives were designed to meet the purpose and need as much as possible, while addressing concerns identified during scoping.

- Proposed Action - Incremental Dam Removal with Ice Control Structure – Currently awarded Act funding would be provided to ODNR, working with the City, to remove the dam over a period of months and years. This includes the construction of ice control structures to mitigate for ice jamming and flooding.
- Alternative 1 - No Action – Currently awarded Act funding would not be provided to ODNR or the City for the Project. Under this alternative the dam would remain in place. The City would rehabilitate the dam to meet safety standards
- Alternative 2 - Fish Passage Structure – Currently awarded Act funding would not be provided to the ODNR or the City due to the language and objectives of the original Act proposal. Under this alternative the City would rehabilitate the dam to meet safety standards, and add a fish elevator structure.
- Alternative 3 - Dam Removal with Ice Control Structure– Currently awarded Act funding would be provided to the ODNR, working with the City, to remove the entire dam during one construction action preceded by the construction of ice control structure to address ice jamming and flooding.

3.1.1 Proposed Action – Incremental Dam Removal with Ice Control Structure

The Proposed Action would be divided into three phases with each phase having multiple objectives for meeting dam removal goals. In summary, the phases are 1.) initial notching of dam; 2.) sediment stabilization, dam removal, and ice control structure construction; and 3.) seawall modification and restoration of the project area. Phase 3 would also include the demolition of any remnants of Tucker Dam, if necessary. A detailed description of the Proposed Action can also be found in Appendix A4. Figure 3-1 provides location information for the Proposed Action. The three phases of demolition, construction, and restoration are discussed further in the following sections.



Basemap: ESRI

Proposed Action Demolition and Ice Control Structure Construction Area

Ballville Dam Project

0 400 800 Feet

Figure 3-1

3.1.1.1 Phase I – Initial notching of Dam

3.1.1.1.1 *Phase 1A – Construct access to south abutment (Approximately September 2014)*

The first action would be to develop a temporary access road to the south dam abutment. Access would be from Yingling Road at its intersection with Laird Drive. From this intersection an existing gravel drive to an Ohio Power Company substation would be used for access and as an equipment staging location after receiving a temporary construction easement from the Ohio Power Company. No trespassing signage and appropriate gating, if necessary, would be posted to control access to the project area. Access to the dam would track northeastward from the existing gravel drive to the eastern edge of a field adjacent to the substation. At the east property line of this field, access would continue northward along the line until reaching the southern dam abutment. Trackhoes and work trucks would be the primary equipment used on the temporary access road.

The access road would be the width of a track hoe and approximately 850 feet (259.1 meters) in length. No improvements such as spread gravel or grading would be anticipated. As necessary, a limited number of trees may require removal at the property line crossing and at the dam abutment work pad location.

The work pad at the south abutment would be approximately 0.5 acre (0.2 hectares) in size. Approximately half of the work pad is wooded and would require tree removal. Limited onsite grading would be required to ensure a level work pad to safely use the trackhoe for Phase 1B. Soil erosion measures such as silt fencing would be put into place to prevent any erosion and sediment entry into the Sandusky River due to clearing and grading at the work pad. Similarly, soil and erosion prevention measures would be installed along the access road, if needed, to prevent unnecessary erosion from occurring.

The access road would be restored to previous condition during Phase 3 of the project. Compacted soil would be loosened and seeded with an approved seed mix. In the planting plan memo, planting zone 5 covers the south abutment access road. This area would be seeded with native upland grasses and forbs. Grading would not be necessary. Planting zone 4 represents the south abutment staging area. This area would have containerized trees planted. Grading would not be necessary (Appendix A6).

3.1.1.1.2 *Phase 1B – Notch spillway and impoundment drawdown (Approximately November 2014)*

Upon completion of the south abutment work pad, a trackhoe with a mounted impact hammer (or hoe-ram) would be used to notch the dam in order to lower the pool incrementally. The notch would be approximately 20 feet (6.1 meters) wide and result in an immediate drawdown of the impoundment by lowering part of the south spillway elevation from roughly 625 feet to 615 feet (190.5 to 187.5 meters). Approximately 96 cubic yards (CY) of concrete from the dam would be removed and directed to fall into a large scour hole below the dam. Completion of the notch would conclude Phase 1.

3.1.1.2 Phase 2 – sediment stabilization, dam removal, and ice control structure construction

3.1.1.2.1 *Phase 2A – Sediment stabilization (Approximately March 2015)*

As a result of Phase 1, approximately 20 acres (8.1 hectares) of sediment currently inundated by the impoundment would be exposed. Stabilization measures would be implemented to reduce potential mobility of the fine-grained sediment stored by the impoundment on these 20 acres. An approved mixture of seed, included containerized trees in some areas, would be broadcast across the exposed surface then mulched to prevent sediment erosion and seed desiccation (i.e. drying out) (Appendix A6). It is anticipated that a motorized spreader would be used; however, other options such as aerial seeding could be utilized if the sediment remains wetted. Approximately 1,500 square bales of hay would be necessary to adequately mulch the seeded area. Access to the area would occur via the south access road. A boat may be used to transport bales of hay and bags of seed so that they may be strategically placed in the area. The length and time of the seeding schedule would be dependent upon the access conditions due to weather and water levels.

3.1.1.2.2 *Phase 2B – Construct access ramp below dam (Approximately May-June 2015)*

Access for equipment to remove the dam would be from County Road 501 and from the American Electric Power (AEP) storage yard adjacent to the dam. Access to the construction site would be controlled by a lockable double swing gate placed on a temporary fence. Approximately 0.3 acres (0.1 hectares) of wooded riparian habitat would be cleared for development of the access road. The access road would be constructed of clean fill and crushed limestone. Some limited cut and fill would be necessary to meet grade specifications needed for construction traffic. The access road would be constructed to allow for dump trucks, bulldozers, and other construction equipment to access the worksite. No refueling of equipment would occur within the Sandusky River. Refueling would only occur within the project staging area (in the AEP storage yard) in order to prevent fuel spills within the waterway.

Once access to the river is established, a temporary work ramp would be constructed to allow access for equipment to reach the top of the south spillway (elevation 625 feet [190.5 meters]). The ramp would be approximately 250 feet (76.2 meters) in length and rise in elevation from 602 feet (183.5 meters) to 620 feet (189 meters) at the dam. The width of the ramp would vary by elevation from approximately 75 feet (22.9 meters) at the base to 10 feet (3 meters) along the top. Total volume of the ramp is estimated to be 7,400 CY of natural rock, crushed rock and concrete rubble. Maintenance of the ramp and access road within the banks of the Sandusky River may be more frequent than at the entry gates due to rise of water elevation during rain events. However, the impact of these rain events and subsequent ramp maintenance are expected to be infrequent due to the location of the ramp (not directly below the notch) and elevation of the modified impoundment pool (less volume being stored). Sediment and erosion control measures would be applied, as appropriate, along the length of the access road and ramp.

Water would not be anticipated to discharge over the north spillway section of Ballville Dam during the Phase 2 Construction period when the river flows are typically at the lowest levels of an annual cycle and the river is being diverted through the notch. The profile of the proposed access road leading to the work ramp does include a low point in the vicinity of the river bed near the north river bank and downstream of the north spillway. This low point in the access road would act as a ford or low water crossing. Should the project site experience a rainfall event that raises the impoundment level and allows water to discharge over the top of the north spillway, the water would then discharge over the low water crossing and continue downstream. The contractor also has the option to install small culverts on the order of 24 to 48-inches in diameter in the current low point of the access ramp to allow any water that may seep through the spillway or north abutment of the dam to drain downstream without impacting the usability of the causeway as dependent on conditions.

As demolition of the south spillway and non-overflow portion of the dam occur, the temporary work ramp would be lowered and/or placed in locations to help control grade of the new bench[2] stepping up to the floodplain. The access road from County Road 501 to the work ramp would be removed during Phase 3; however the portion from County Road 501 through the wooded riparian area would remain in place for future access for removal of the debris from the ICS as well as future recreational access.

3.1.1.2.3 *Phase 2C – Construct ice control structures (Approximately July-October 2015)*

Access for construction of the ice control structures (ICS) would be via the access road of Phase 2B, described above. Construction of the ICS would be located 175 feet (53.3 meters) downstream of, and parallel to, the dam. The ICS consists of 15 piers spaced 21 feet (6.4 meters) apart on centers. Overall, the piers would be 25 feet (7.6 meters) tall and six feet (1.8 meters) in diameter. Piers would be embedded approximately 15 feet into the bedrock and extend 10 feet above grade. Exposure above grade would vary based on river bed; however, piers would be uniform in top elevation at 610 feet (185.9 meters) (Appendix A5).

The installation of the ice control structure (ICS) can be performed during modestly active flow conditions anticipated during the low flow annual periods. The Contractor would use best management practices to isolate drill cuttings and prevent concrete from entering the watercourse during installation of the piers. The Contractor would implement water management practices during the installation of the ICS piers to maintain flow in the Sandusky River.

The contractor will access the pier locations using equipment placed directly in the riverbed. During drilling and construction of the piers, river flow will be temporarily diverted around the immediate work area, thereby preventing drill cuttings and concrete from entering the

[2] Benches refer to areas that are bank-attached, planar and narrow, fine-grained sediment deposits occurring between the river bed and the floodplain.

watercourse. It is assumed the contractor will use a large track-mounted drill rig to core bedrock. Drill cuttings may be used onsite for the access ramp to the dam. Concrete for the ICS piers will be delivered from local suppliers using commercial rubber-tired transit mixers.

The riverbed in this area is exposed bedrock with a few areas covered or filled with fine and course sediment. The contractor may require further temporary leveling for equipment access and safe construction. Leveling material, such as sand and gravel, may account for approximately 50 cubic yards of temporary fill within the Sandusky River.

The contractor, in conjunction with the planned access ramp for the dam, would likely build a temporary access road parallel to the entire length of the ICS alignment (Figure 3-1). This road would facilitate access for smaller rubber-tired vehicles and be safer for workers on foot. The road would contain approximately 700 cubic yards of fill, mainly placed within the Sandusky River (540 cubic yards, 0.103 acres). Approximately 80 cubic yards would be placed within Jurisdictional Wetland 18 (0.019 acres) and 80 cubic yards in Wetland 6 (0.015 acres). The access road would be comprised of materials, such as large gravels and cobbles, capable of withstanding river flow. The road may have a low section to pass water flow over the access road surface. Alternatively, a number of conduits may be installed beneath the road to pass expected flows. River diversion may be local to each pier or installed to surround groups of piers as construction proceeds. River flow may be diverted partially, depending upon the location of the work. Flows through main channels would be split around pier worksites within the center of the channel. The particular system used to accomplish this would be the responsibility of the Contractor.

For ICS construction, the contractor would generally follow the below sequence:

1. Create a level access path for the construction equipment (or the equipment would travel on the exposed rock river bed) along the ICS alignment.
2. Install a river diversion system (coffer, water dams, etc.) in order to work “in the dry.”
3. Install drip pans/trays beneath equipment to catch oil and gas leaks.
4. Install a local diversion (sandbags, etc.) at each pier site to guard against cuttings and concrete from entering the water course. Deploy seepage sumps and pumps.
5. Upon completion of construction remove from the river bed any equipment, materials and placed fill.

Each pier would be constructed in three parts: drilling, reinforcement placement, and concrete placement by tremie method (pumping from the bottom up). Each shaft would be drilled approximately 15 feet into the bedrock. A truck mounted drill rig with a 6-foot (1.8 meters) diameter toothed core drum would remove 1 to 3 foot-long (0.3 to 0.9 meter) plugs of bedrock.

Each plug would be extracted and drilling continued until the required depth is attained. After drilling, reinforcement is added. Reinforcement would consist of a six foot diameter circular form and a mesh of rebar assembled for structural strengthening. A cylindrical form for the concrete would extend at least 12 feet above grade to elevation 610 feet (185.9 meters). Tremie concrete would be used to fill the form, displacing any collected water. The fill volume for each pier would be approximately 26 CY and would be comprised of steel reinforced concrete. The entire ICS (15 piers) would result in nearly 390 CY of poured concrete.

Equipment would be staged in the north staging area and refueled daily at this location. It is estimated that shaft construction, including drilling, reinforcement and concrete placement, could occur at a rate of one pier per day. Concrete placement is likely to occur in groups of five to 10 piers for concrete delivery efficiency. A concrete pump truck and an estimated 40 concrete mixing trucks (roughly three mixer loads per pier) would access the project area via the north access road. After the concrete has hardened the circular forms would be removed exposing the structure.

During the 50 to 75 year service life of the ICS, various maintenance activities would be required to extend each pier's service years. Concrete may experience spalling and abrasion throughout its service life. These areas would be patched with Portland cement grout or epoxy. Routine inspection of the structures would be necessary to ensure that the reinforcement is not exposed and that the concrete is maintained.

Periodic removal of debris that may accumulate on the structure may be necessary. The modified access along the north bank would be kept clear of vegetation for periodical access to the ICS for clearing debris (i.e. limbs and trees) and maintenance.

3.1.1.2.4 *Phase 2D – Remove dam (Approximately September-November 2015)*

After completion of Phase 2B an access road would be in place to begin demolition of the remaining dam. However, it is not until near completion of Phase 2C that demolition would begin. Demolition of the dam was originally planned to stop at the north abutment where the current carbon feed building is located as described in Appendix A4. However, the City and their contractor may determine it prudent to remove the structure during this phase in the interest of public safety and structural integrity. Demolition is expected to take approximately three months to complete including removal of the Phase 2B access ramp.

Demolition of the dam would be accomplished by a trackhoe (or hoe ram) accessing the top of the dam and enlarging the original notch from the access ramp (north). The bottom elevation of the notch would be lowered from elevation 615 feet to 610 feet (187.5 to 185.9 meters). This would allow for additional impoundment drawdown to occur while the trackhoe/hoe-ram demolishes the top of the remaining south spillway. As the south spillway is demolished, additional equipment would work to demolish the non-overflow section of the dam and move northward to demolish the north overflow area. Debris from the demolition would be directed to fall into a two large scour holes downstream of the south spillway and north overflow. The access ramp constructed in Phase 2B would be removed as the dam is reduced in elevation.

The Ballville Dam structure is constructed of approximately 15,000 CY of reinforced concrete consisting of clean concrete materials (approximately 14,000 CY) made from sand and gravel river materials and approximately 800 to 1,000 CY (loose) of steel rebar. During demolition, the contractor would be instructed to only permanently fill with unreinforced concrete into the designated disposal areas (i.e. scour holes). This would require the contractor to separate the steel rebar for offsite disposal. The separation process involves breaking up the larger concrete materials into boulder to cobble size rubble using a jack hammer or hoe-ram and separating the different materials using a claw, front loader, or bull dozer. A bulldozer may be used to push and spread the clean fill materials. An estimated 1,000 CY (loose) of steel rebar and unseparated concrete (i.e. tangled within the rebar) would be hauled offsite for disposal. The cost of hauling would be approximately $10,000.00 (estimated $10.00 per CY). The entire volume of debris from demolition of the dam is estimated to be 15,000 CY. Some of the metal materials in the dam such as the old penstock, sluice gates, and raw water intake apparatus would be removed from the demolition area upon extraction. Approximately 1,900 CY of clean concrete rubble fill from the demolition would remain in the two concrete disposal areas (scour holes) in order to level the river bed.

If the carbon feed building is demolished, it would be demolished using a claw, front loader, or bull dozer. All of the demolition materials would be hauled offsite for disposal.

3.1.1.2.5 *Phase 2E – Channel restoration (Approximately November-December 2015)*

After demolition of the dam, channel restoration would occur. Restoration of the project area would include approximately 28,000 CY of fill consisting of offsite rock and soil materials as well as some concrete rubble from the demolished dam and leftover access ramp. This material would be used for grading of the new bank benches (Section 3.1.1.2.2).

The proposed channel grading will consist of 1) placement of fill downstream of the current dam location, and 2) fill cut upstream of the current dam location. This channel shaping will result in construction of a terrace (Section A-A' on sheet 8 of 19 in Appendix A5). Without this terrace the river could potentially flank the ICS rendering it ineffective.

The notching of the dam in Phase 1B is designed to “train” the river to flow through the restoration area to the south (Sheet 10 of 20 of Proposed Action Memo Appendix A4). While it is expected that the river would naturally grade it, there may be need to grade a channel lead starting approximately 300 feet (91.4 meters) upstream of the dam. Once the stream reaches bedrock the stream would be fairly set and grading of the benches on either bank can occur. Any rubble used as fill would be buried with soil. Earth moving equipment such as track hoes, bulldozers, and other equipment would be used to grade the benches (Section 3.1.1.2.2) such that they would have a more gradual slope along the sea wall and downstream to the access point. Grade ratio would depend on need at the time of restoration. Stabilization measures would be used to prevent erosion. These measures include seeding and vegetative strategies designed to control invasive plant colonization. A planting plan was designed, detailing a planting list (common name, Latin name, and wetland indicator) for each seed mixture species and the estimated seeding rate (Appendix A6). The planting plan will be part of the Section

404/401 Clean Water Act permit application and water quality certification process. Construction plans would include the planting plan, which details planting zones, cost estimates, environmental covenant, and plant species list to be used.

Information regarding in-kind-mitigation is discussed in the planting plan and a commitment to reforest the site by planting bare root saplings and containerized trees is made (Appendix A6). However, the objective of the planting plan is to stabilize the site and combat the proliferation of reed canarygrass. This would provide the seed bank the opportunity to propagate forest succession. All disturbed areas would be replanted with the exception of the north access road. This access point would be maintained by the City for routine ICS maintenance and potentially a recreation access point in the future.

As restoration is being completed, removal of the remaining temporary ramp from Phase 2B would occur. Access to the river for motorized vehicles would be controlled by a gate. Additionally, the south abutment access road from Phase 1A would also be restored to conditions prior to construction.

3.1.1.3 Phase 3 – Sea Wall modification and restoration of the impoundment area

3.1.1.3.1 *Phase 3A – Monitoring Channel Restoration and Water Supply Intake (Approximately Summer 2016)*

As Phase 2D is being completed, monitoring of the City's reservoir intake, approximately 1.5 river miles (2.4 river kilometers) upstream of the dam, would occur to ensure that, during the lowering of the impoundment, no sediment blockage occurs due to instability of upstream banks. Similarly, stability of River Road would be monitored (just southwest of the intersection of River Road and Buckland Avenue) to ensure that no impacts to infrastructure occur as a result of the pool drawdown. If stabilization is necessary, appropriate measures would be implemented to safeguard both the intake and roadway.

3.1.1.3.2 *Phase 3B – Remove any remaining dam material and modify seawall (Approximately August-November 2016)*

After Phase 3A, any material stockpiled in the staging area or along the access road would be removed from the site. The temporary work area gating would be removed and permanent gate and appropriate signage installed limiting access to the project restoration area.

Additionally, in this phase, the sea wall would be modified. The wall is approximately 702 feet (214 meters) long and 1.5 feet (0.5 meters) wide with an average height of five feet (1.5 meters). The sea wall would be reduced in height, mechanically, to grade while keeping the below-grade portion in place. Approximately 195 CY of concrete would be removed and disposed of appropriately. Any rebar or other reinforcement would be cut flush with the remaining base. A permanent fence would then be placed atop of the remaining wall for safety, to prevent members of the public from falling from the top of the sea wall to the riverbank below. Upon modification of the sea wall and installation of the fencing the project would be completed. Phase 3C would be initiated, if necessary, after completion of Phases 1 through 3B.

3.1.1.3.3 *Phase 3C – Remove Tucker Dam – if necessary (Approximately Fall 2016)*

Removal of Ballville Dam and pool is expected to expose the Tucker Dam, if present, either whole or in part. The initial notch of the dam in Phase 1B would lower the impoundment to the point where evidence regarding whether the dam may still be in place and its potential to impact the success of the Proposed Action could be determined. If the Tucker Dam is intact and requires action, the Programmatic Agreement between the Service, Consulting Parties, and the OHPO provides guidance for removal based on its disposition (Appendix D1). If Phase 1B provides evidence of the structures existence then it would be assessed in order to delineate concerns for safety and effectiveness of the restoration based on its presence. An adaptive strategy may be necessary to assess if removal should occur prior to Phase 3C. If removal is necessary, best management practices would be employed to remove the structure.

3.1.1.3.4 *Phase 3D – Monitoring and Adaptive Management (*Multi-year*)*

The final phase of the project would occur for multiple years post-removal and would involve monitoring and adaptive management. Monitoring of wetland formation, areas of erosion and deposition, water quality, fish diversity and movement, and mussel relocations would occur to document ecological impacts of dam removal as well as compliance with Section 10/401/404 permits from the USACE and OEPA. Adaptive management could include shaping the floodplain topography to promote the formation of fringe wetlands and/or floodplain wetlands, addressing rilling or gully formation on exposed sediments upstream of the dam, excavation near the reservoir intake to improve flow, or other adaptive actions to address erosion or habitat enhancements as upstream river conditions change.

3.1.1.4 Proposed Action Estimated Cost Opinion

The Proposed Action would remove the Ballville Dam in three distinct phases, as discussed above. Construction cost opinion is approximately $3.6 million with a 20 percent contingency (Table 3-1). Operation and maintenance costs add an additional $400,000. When considering all aspects of the Proposed Action the total cost opinion is $6,288,216. Additional costs may be incurred if compensatory mitigation for wetland impacts is required as a result of the USACE Section 404/10 permitting process for this alternative. The need for additional compensatory mitigation has not yet been determined, thus a cost estimate has not been generated yet nor included here. There are $2 million awarded by the Service through the Great Lakes Fish and Wildlife Restoration Act to ODNR and approximately $5.8 million awarded by OEPA through the WRRSP program available to carry out this alternative.

Table 3-1. Proposed Action Estimated Cost Opinion

No.	Item	Total Cost
Construction Phase		
1	Mobilization / Demobilization (~5%)	$150,000
2	Portable Sanitation Units	$4,000
3	Project signs	$5,000

Table 3-1. Proposed Action Estimated Cost Opinion

No.	Item	Total Cost
4	Stabilize construction access w/culverts	$100,000
5	Concrete hoe-ramming	$1,822,500
6	Concrete Disposal	$126,000
7	Loading out concrete for disposal	$105,000
8	Hauling concrete off site	$52,500
9	Channel tuning with excavator	$60,000
10	Erosion control barrier	$8,000
11	ICS Coffer dam for water diversion	$56,250
12	Floodplain protection (rock or wood bollards)	$12,000
13	ICS Dewatering pump/treatment system	$60,000
14	ICS caissons	$380,000
15	ICS Caisson rock excavation	$353,400
16	ICS Caisson rig mob/demob.	$36,000
17	Steel Reinforcing	$227,130
18	Topsoil	$21,000
19	Plantings (1 gal)	$25,000
20	Plantings (bare-root seedlings)	$4,000
21	Soil conditioning (limestone)	$1,000
22	Seeding (mechanical)	$60,000
23	Seeding (manual)	$2,500
24	Erosion Control Blanket	$18,900
	Total Construction:	**$3,690,180**
	Construction Contingency (20%)	**$698,036**
Operation and Maintenance (O & M)		
1	North Abutment and Carbon Feed	$200,000
2	Bank Stabilization	$200,000
	Total O & M Cost:	**$400,000**
Design and Permitting		**$1,100,000**
	Total Dam Removal Costs:	**$6,288,216**

3.1.1.5 Proposed Action Summary

Removal of the Ballville Dam, and Tucker Dam if needed, over a multi-event period would meet the purpose and need for the project. It would provide fish passage in both directions, restore system connectivity and natural hydrologic processes in the lower Sandusky River, manage sediment loads, as well as eliminate the liabilities associated with maintaining the existing structure and achieve biological use attainment for this section of the Sandusky River.

3.1.2 Alternative 1 – No Action Alternative

This FEIS requires analysis of a "no action alternative" for comparison with other action alternatives. Under this alternative, federal funding would not be provided to remove the structure. Instead, it is expected that the Ballville Dam would remain in place and require extensive rehabilitation to be compliant with ODNR dam safety standards. The ARCADIS (2005) investigation report provided findings regarding methods and cost estimates to rehabilitate the Ballville Dam. In November 2013, MSG provided an investigation report that updated the findings and cost estimates for rehabilitation of the Ballville Dam based on the 2005 ARCADIS report. The No Action Alternative is based on conclusions and recommendations provided in these reports.

Below are the expected rehabilitation items included in the No Action Alternative. Figure 3-2 provides a depiction of where primary rehabilitation would occur.

3.1.2.1 Lake Drain

The "lake drain" refers to the sluice gates on the dam. Six gates were originally built, but after the 1969 modification only two remained operational. In 1980, the ODNR found one sluice gate was inoperable and the other was leaking to some degree (ODNR 1981). In order to repair concrete deteriorations on the dam, the water level on the impoundment would need to be lowered by opening the sluice gate(s). In order for the sluice gates to be opened, they must first be repaired. Additionally, it is required for dam safety that these gates be operable (ODNR 2004). The probable costs of construction include costs for marine equipment and labor for sluice gate rehabilitation (ARCADIS 2005 and MSG 2013).

Design of the "lake drain" repair is not complete. It is anticipated that an area around the sluice gates would dewatered by use of coffer dams around the gate area to minimize any sediment release from the replacement. This would enable rehabilitation or replacement to be conducted "in the dry" to eliminate influence of sediment stores and hydraulic pressure.

3.1.2.2 Concrete Repairs

Considerable concrete deterioration has occurred on the dam; especially in those areas that were repaired in 1969. Additionally, there is some limited scour beneath the toe of the spillway sections and central non-overflow section that require filling. ARCADIS (2005) found these conditions nonthreatening to water retaining structures, but recommended their repairs for long term serviceability of the dam. In 2013, MSG found these conditions continuing to deteriorate. Specific detail and location where concrete repairs are needed are discussed in the No Action Alternative Memo (Appendix A7). The primary items are:

- Replacement of shotcrete on the left abutment downstream training wall;

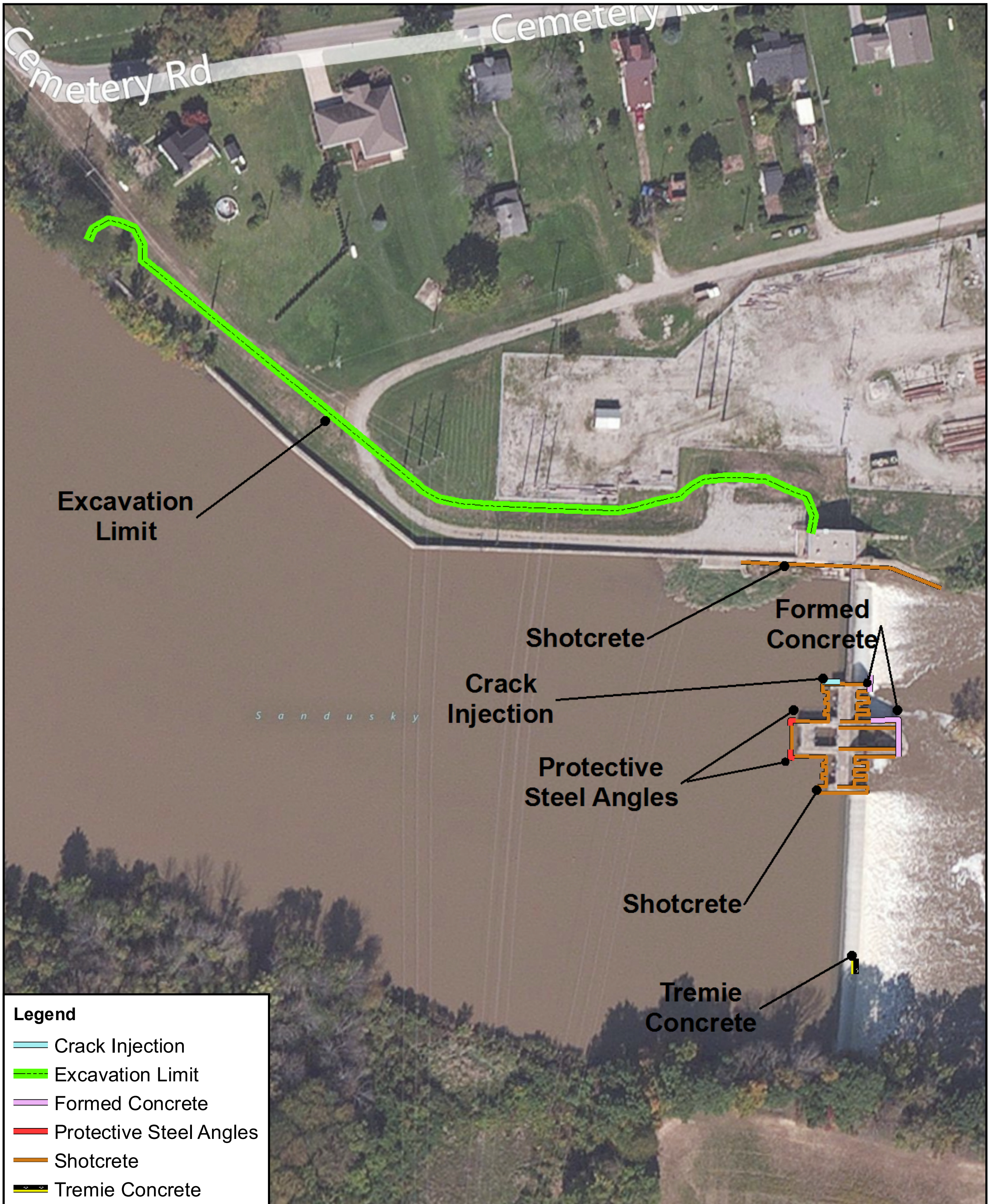
- Replacement of shotcrete on all surfaces of the central non-overflow walls;
- Installation of formed concrete at the downstream end of the central non-overflow section and base of the training wall next to the left spillway and non-overflow section to fill scoured voids below the current forms;
- Filling of the void under the toe of the right spillway section;
- Installation of steel angles on the upstream corners of the raw water intake for protection; and
- Injection of epoxy into cracks in the left side of the central non-overflow section.

There are several options for replacement of concrete. Replacement of shotcrete would be accomplished by removing all loose material, cutting the void edges with a saw, using anchoring wire mesh in the void, and reapplication of shotcrete. This repair would not be permanent but would likely last approximately 30 years based on previous environmental conditions. A second option to improve concrete conditions would be the application of a polymer modified concrete that has enhanced adhesion properties for reduction in permeability. Polymer modified concrete would likely have a longer lifespan than shotcrete and extend repair life to 50 years (MSG 2013).

The filling of voids along the downstream toe would require preparation of the surface by cutting the edges and installing wire mesh that is securely anchored to the prepared surface. In order to fill below the waterline, polymer modified concrete would be tremied in the wetted conditions to fill the void. Installation of formed concrete at the downstream end of the central non-overflow section and at the base of the training wall next to the left spillway and non-overflow section would be completed at the same time and forms used to fill voids.

ARCADIS (2005) noted that steel plating was used below the water line for protection against debris impact into the structure prior to falling over the spillway. Installation of similar steel plating would be used to help reduce continued deterioration. Installation would require replacement of the shotcrete (as described above) and then securing steel plates along the corners with drilled shafts for large welded rebar/steel bars.

Injection of the epoxy into cracks would require surface preparation and cleaning and then injection of the epoxy for filling. This action would help prevent these areas from further deterioration from thaw/freeze and other environmental conditions.



Basemap: BING

No Action Alternative Primary Areas of Rehabilitation

N W E S

Ballville Dam Project

0 60 120 Feet

Figure 3-2

Construction access to the structure for filling voids and other repairs and rehabilitation was not specifically described in either report. Access to rehabilitate the downstream side of the dam is likely to require development of an access point along the northern bank similar to that described in the Proposed Action. Access to the upstream rehabilitation areas may occur via upstream barge or from atop the dam. These are only a couple of the possibilities. Prior to initiation of rehabilitation, the City and its selected contractor would develop specific plans for access.

3.1.2.3 Sea Wall

The sea wall was found by ARCADIS (2005) to be at risk of failure in floods that would crest the wall (>50,000 cfs). The overflowing water would erode the backfill and possibly cause collapse. Vegetation behind the seawall is maintained grass with no trees or other deep rooted vegetation. This is similar to the condition that destroyed the dam during construction in 1911. Two solutions were developed in order to prevent the sea wall from failing: a gravity alternative and a post-tension alternative.

The gravity alternative would remove the soil behind the sea wall down to rock and replace it with a non-erodible material that would remain stable during a cresting of the wall. ARCADIS (2005) proposed roller compacted concrete (RCC) or rock fill consolidated with grout as possible materials. The No Action Alternative Memo provides a typical cross section using the gravity alternative (Appendix A7).

The second alternative for addressing the sea wall stability is the post-tension alternative. This alternative requires the installation of post-tensioned anchors in the sea wall. This alternative assumes that the concrete in the existing seawall is suitable and that subsurface rock is capable to resist the anchor loads. Extensive geotechnical investigation of both the subsurface rock and the sea wall would be necessary to confirm the feasibility of this alternative. The No Action Alternative Memo provides a typical cross section using the post-tensioned alternative method (Appendix A7).

3.1.2.4 Operational Manuals

In order to bring the dam into compliance, two documents would be developed: 1.) an operations, maintenance, and inspection manual; and 2.) an emergency action plan. These documents would provide discussion of the various modifications and utilize the results of hydrology and hydraulics modeling.

3.1.2.5 No Action Alternative Estimated Cost Opinion

In 1980, the ODNR identified deficiencies with the Ballville Dam that has been recommended for repair and rehabilitation. Currently, the dam and sea wall are not operating in accordance with ODNR safety standards. The table below provides estimated opinion of costs for rehabilitation of the dam to meet ODNR standards based on the revised cost estimates from MSG (2013). The No Action Alternative ranges from $8.9 to $10.7 million based on 2013 estimates (Table 3-2). The increase concrete repair costs from 2005 are based on differences in the design and administration of construction. These costs are approximately $4.9 to $5.6 million more than estimates prepared in 2005. Details of the opinion of costs are presented in the No Action Alternative in Appendix A7.

Cost estimates varied between 2005 and 2013 based on, but not limited to, the following: method of concrete rehabilitation, increase in rehabilitation amounts needed, pricing of concrete removal, increase in overall material costs, mobilization increases, other items not previously considered, increase in design and construction engineering and administration that are likely to be realized (MSG 2013).

There are no funds available from the Service or OEPA to carry out this alternative. The City has indicated that increases in the cost of water rates for the local community may be required to carry out this alternative. There is also the potential for repayment of $5 million dollars from the City to ODNR related to an agreement identified during project scoping (Section 2.1.2).

Table 3-2. No Action Alternative Estimated Cost Opinion

Item	Costs
Concrete Repairs	$6.4 Million
Sea Wall Stabilization	
Gravity Alternative	$2.4 Million
Post-tension Alternative	$4.2 Million
Operational Manuals	$33 Thousand
Total Estimated Costs*	$8.9 - $10.7 Million

Source: Mannik & Smith Group 2013; ^ ARCADIS 2005

3.1.2.1 No Action Alternative Summary

Repair and maintenance of Ballville Dam do not meet the purpose and need for the project. This alternative would correct the progressive deterioration of the dam and associated sea wall to comply with state-mandated dam safety requirements however it would not provide fish passage, restore system connectivity or natural hydrologic processes in the lower Sandusky River, or eliminate the liabilities associated with maintaining the existing structure in perpetuity.

3.1.3 Alternative 2 – Rehabilitate dam, install Fish Passage Structure

Alternative 2 outlines the rehabilitation and continued maintenance of Ballville Dam, bringing it into compliance with relevant safety and operation standards, as described in detail in Alternative 1, but also includes the construction of a fish elevator structure to allow for upstream movements of native fish species. The ARCADIS (2005) investigation report, with new information from the 2013 MSG report, are the most current assessment available for the Ballville Dam; therefore, this alternative is based, in part, on conclusions and recommendations provided in those reports as described in Section 1.3.2. The ARCADIS (2005) report presented several remediation needs for the dam and sea wall. These same repairs would be necessary to rehabilitate the dam prior to installation of a fish elevator system. Also note that the currently available federal funding would not be provided to assist in the construction of this alternative.

3.1.3.1 Fish Passage Design and Operational Requirements

Primary design components of the fish elevator would be constrained by the need for continuous mechanical operations during seasonal migration periods to provide for upstream fish passage. Typical components of a fish elevator include 1) siting at an appropriate location along the downstream side of the dam, 2) provisions for suitable attraction flow to guide fish into the inlet, 3) a trap system, 4) a lifting system, 5) sorting system, and 6) a fishpass outlet. General concepts for these six components are described below. Figure 3-3 provides a conceptual layout of what a fish elevator system may look like at the Ballville Dam.

3.1.3.2 Design Criteria for Ballville Dam

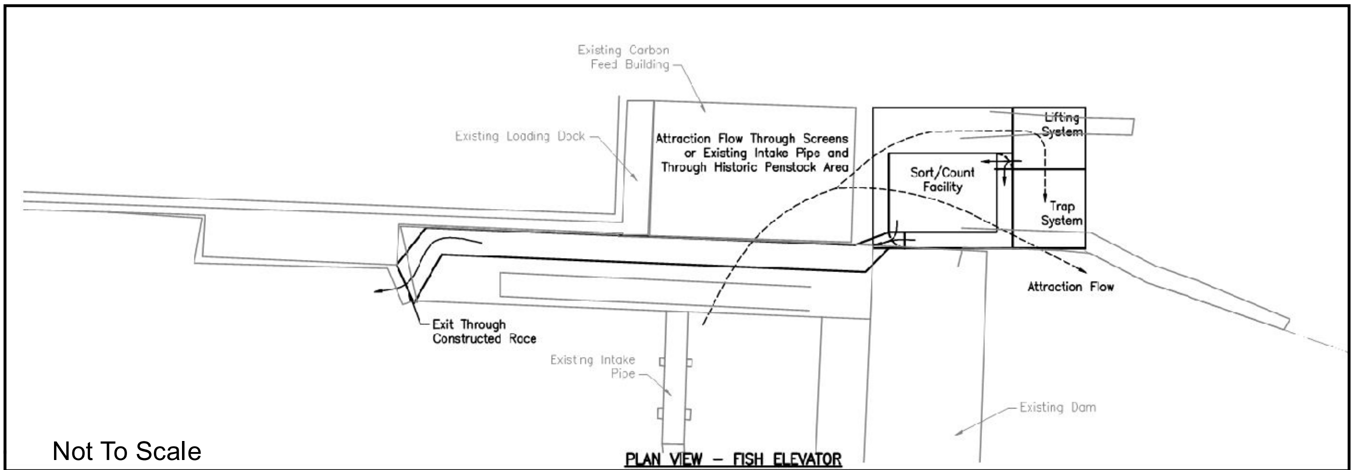
The objective of a fish elevator system would be to provide for upstream passage of fish that are commercially and ecologically important in the Sandusky River. Those fish species at Ballville Dam include Walleye, White Bass, and Greater Redhorse. A fundamental component of a fish elevator system at Ballville Dam is trapping of fish prior to lifting the elevator component for release upstream. Fish elevators do not provide for volitional upstream fish passage. The provision for trapping fish and allowing for exclusion of undesirable and/or invasive species such as Sea Lamprey (*Petromyzon marinus*) and Asian Carp is one benefit of the system.

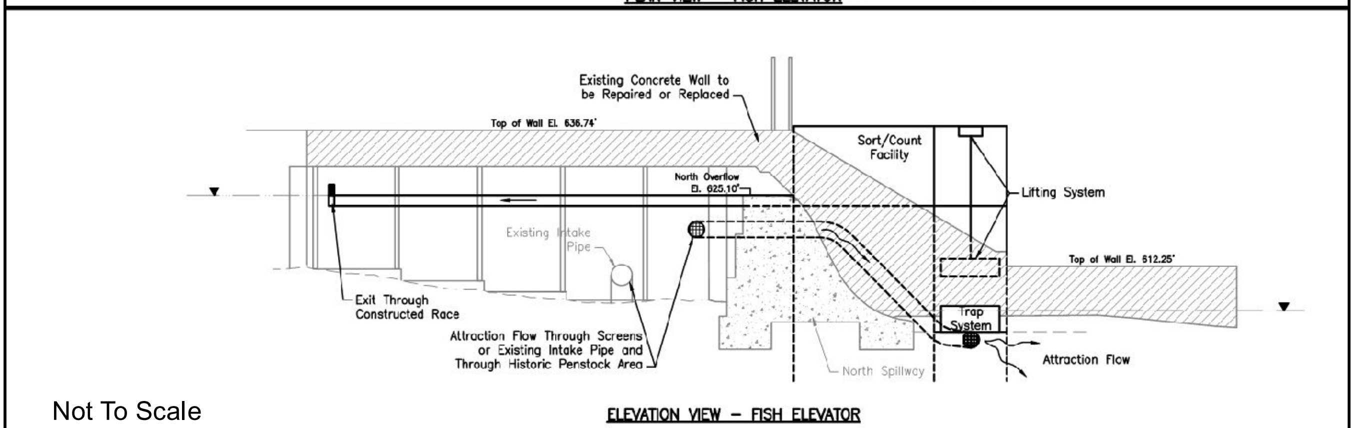
Peak migration periods for three target fish species for upstream passage at Ballville Dam are presented in Table 3-3 along with seasonal flow statistics developed as part of the Ballville Dam Removal Feasibility Study (Stantec 2011b). A fish elevator system is not necessarily as constrained as a flow-through fish passage system (e.g. fish ladder) by low and high flow conditions, and, conceptually, may function at a broader range of flows relative to a flow-through system. However, fish must be able to reach the entrance to the fish elevator system and must be able to successfully exit the system and proceed upstream.

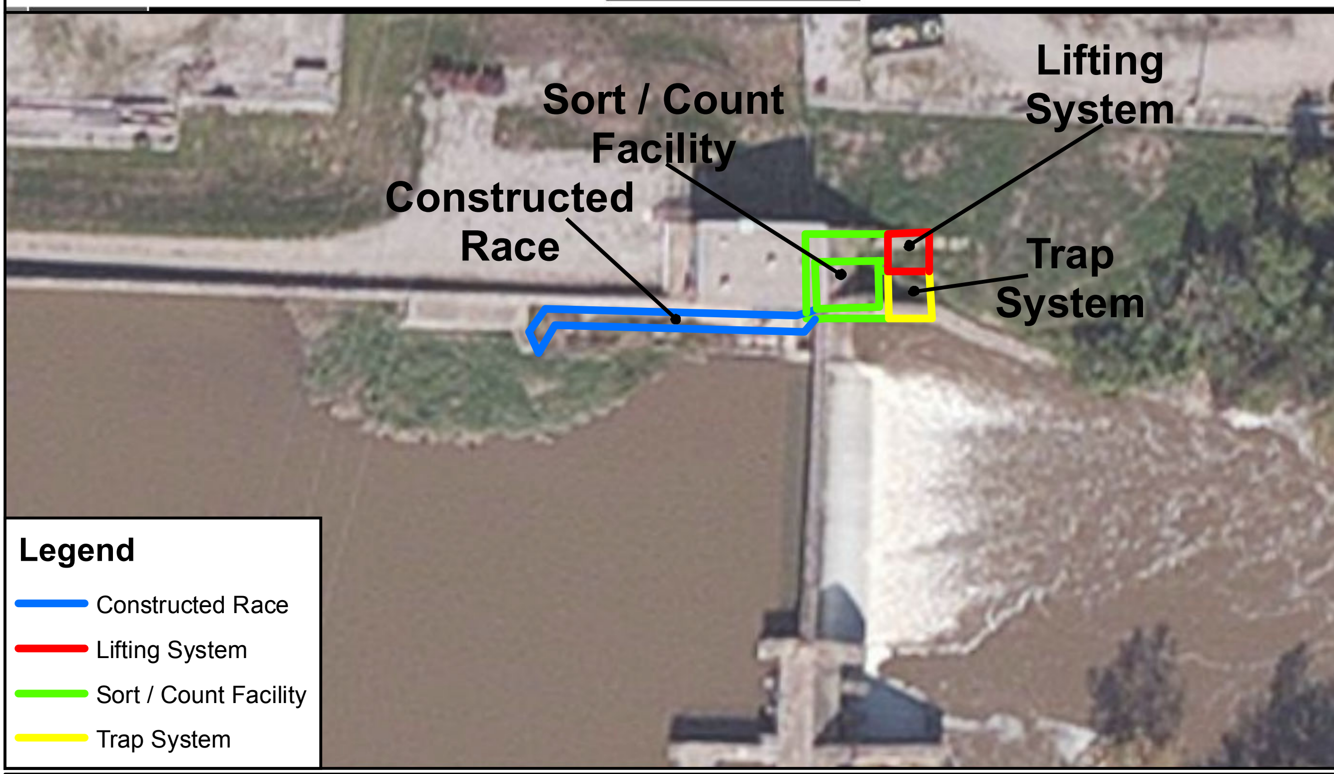
Table 3-3. Seasonal Migration and Staging Periods for Target Fish Species

Fish Species	**1-Mar**	**15-Mar**	**1-Apr**	**15-Apr**	**1-May**	**15-May**	**1-Jun**	**15-Jun**
Walleye								
White Bass								
Greater Redhorse								
	Monthly Hydrologic Statistics (cfs)							
Flow Statistic	March		April		May		June	
75% Exceedance	510		467		288		156	
Median	954		1020		476		341	
25% Exceedance	2,490		2,400		1,075		800	

= Low-Level Activity
= Peak Activity







Basemap:
BING

Alternative 2 - Fish Elevator System Conceptual Design

N W E S

Ballville Dam Project

0 30 60 Feet

Figure 3-3

The commercially and ecologically important species in the project area typically spawn between March and mid-June; therefore, the fish elevator would be active during this period of the year to allow fish to move upstream to spawn. The system would not be operated during other parts of the year. A review of stream gauging data for that period showed that median stream flow ranged between 341 and 954 cfs (Table 3-3). For design purposes it was assumed that upstream fish passage was optimal between the 75^{th} and 25^{th} exceedance percentiles. Thus the range of flows during which a fish elevator at Ballville Dam would provide for safe, timely, and effective upstream fish passage for the target fish species ranged from approximately 150 to 2,500 cubic feet per second (cfs).

3.1.3.2.1 Siting

The area adjacent to the left abutment of the dam appears to be generally suitable for installation of a fish elevator. A primary requirement is that the structure be located where it is not subject to damage from flow passing over the north spillway and can be generally seen on Figure 3-3

3.1.3.2.2 Attraction Flow

Attraction flow would be necessary to guide fish into the trap entrance at the base of the fish elevator. The entrance would likely be an opening in the existing wall large enough to allow for fish to enter the elevator system. The general configuration of this system would be similar to a flow-through fishpass. The design of the attraction flow would consider information on hydraulic conditions in the area immediately downstream from the north spillway and further downstream. Selection of an appropriate attraction flow discharge and orientation of the attraction “jet” at the base of the dam would be based on flows during the seasonal upstream passage period(s). The attraction flow would be parallel to the retaining wall that extends downstream from the north abutment of the dam.

The volume and jet velocity of the attraction flow depend on a variety of factors; a conceptual estimate of total attraction flow is 50 cubic feet per second (cfs), comprised of 25 cfs discharged through the trap system and 25 cfs of augmented attraction flow discharged into the plunge pool in the immediate vicinity of the trap inlet. Both the trap system and augmentation flow would be provided using conduits from the upstream impoundment with appropriate controls and fittings (e.g., valves, diffusers).

Given the general unsuitability of the Ballville Dam to direct fish to the plunge pool immediately downstream from the north spillway, modifications of the downstream channel may be appropriate to guide fish to the fish elevator facility if it is deemed necessary based on post project monitoring and passage success.

3.1.3.2.3 Trap System

The trap system would be located upstream from the fishpass entrance. In general, the trap would be similar to a fyke net; with fish passing through a narrowing slot prior to entering the trap that is part of the lifting system. Attraction flow (assumed here as 25 cfs) would be routed through the trap system. A temporary closure fence would be used at the inlet of the trap; this fence would be closed prior to lifting and reopened upon completion of a lifting cycle when the trap is returned to the bottom of the trap well.

3.1.3.2.4 Lifting System for Fish Passage Structure

The lifting system would be comprised of a “lift bucket” to allow fish to be persistently wet during vertical transport. The lift bucket would have a minimum internal dimension of at least 4 feet by 6 feet by 2 feet (1.2 by 1.8 by 0.6 meters). This would allow the volume of water in the lift bucket to be sufficient and limit the potential for asphyxiation of fish due to oxygen depletion during lifting. The lift speed would be 0.5 feet/second (0.2 meters/second) to a lift height of 30 feet (9.1 meters), the duration of lifting would be 60 seconds.

The conceptual lift bucket volume would be 48 cubic feet (approximately 360 gallons [1,362.8 liters], 3,000 pounds [1,360.8 kilograms]). Screening along the side would allow for draining-off of water during lifting and containment of fish.

To avoid potential system failure and release of fluids as a result of hydraulic leaks or bursts, a mechanical chain hoist or winch system would be used for lifting the bucket. The fish elevator would be cycled (up and down) approximately every 15 minutes. This allows for the sorting station to complete its task between lift cycles. During periods when numbers of migrating fish are low, filling of the trap would represent a limiting factor on cycle time.

3.1.3.2.5 Sorting System

Exclusion of undesirable species would be part of fish elevator operation at Ballville Dam. Removal and disposal of upstream migrating invasive species such as Asian Carp and Sea Lamprey, if present, would be required at the upstream fish elevator system on Ballville Dam. The construction of a trapping and sorting facility with a lift or lock system would facilitate part of the project. Such a facility would be best located at the fish elevator outlet. This system would include holding pools and means to effectively sort, capture, and dispose of undesirable and/or invasive species. The sorting system would be enclosed in a building so that sorting staff of one or more employees could sort fish without influence of the outside weather (i.e. temperature, precipitation, lightning hazards, etc.). The current carbon feed building would be adequate in size and position to support this facility.

3.1.3.2.6 Fishpass Outlet

The fishpass outlet would be located upstream from the north spillway. This structure would be designed and built to ensure fish can successfully move upstream from the fishpass outlet with minimal risk of being swept downstream and over the spillway. Most fishpass outlets are small concrete canals that extend upstream that allow for the fish to safely pass upstream without fighting current. At Ballville Dam, the outlet would direct fish to the Sandusky River approximately 100 feet (30.5 meters) upstream along the northern edge of the river.

3.1.3.3 Fish Passage Structure Alternative Estimated Cost Opinion

In 1980, the ODNR identified deficiencies with the Ballville Dam that has been recommended for repair and rehabilitation. Currently, the dam and sea wall are not operating in accordance with ODNR safety standards. The table below provides estimated opinion of costs for rehabilitation of the dam to meet ODNR standards as well as the addition of a fish elevator system. The Rehabilitate Dam and Install Fish Passage Structure Alternative ranges from $16.8 to $18.6 million based, in part, on 2013 estimates of rehabilitating the dam (Table 3-4). The concrete repair differences are based on differences in the design and administration of construction. Details of the opinion of costs are presented in the Rehabilitate Dam and Install Fish Passage Structure Alternative in Appendix A8.

There are no funds available from the Service or OEPA to carry out this alternative. The City has indicated that increases in the cost of water rates for the local community may be required to carry out this alternative. There is also the potential for repayment of $5 million dollars from the City to ODNR related to an agreement identified during project scoping (Section 2.1.2).

Table 3-4. Estimated cost for Fish Elevator System

No.	Item	Total Cost
Dam and Sea Wall Rehabilitation (ARCADIS 2005; MSG 2013)		
1	Concrete Repairs	$6.4 Million
2	Sea Wall Stabilization	
2a	*Gravity Alternative*	$2.4 Million
2b	*Post-tension Alternative*	$4.2 Million
3	Operational Manuals	$33 Thousand
	Total Rehabilitation	**$8.9 - $10.7 Million**
Construction of Fish Elevator System Phase		
1	Coffer dam	$150,000
2	Tailrace excavation	$250,000
3	Fishway foundation elements	$200,000
4	Steel superstructure (structural elements)	$225,000
5	Fishway controls (mechanical elements)	$175,000
6	Fishway attraction flow piping	$350,000
7	Volitional channel, control gate	$300,000
8	Construction phase engineering support	$90,000
9	Construction QA/QC	$120,000
	Total Construction:	**$1,860,000**
	Construction Contingency (30%)	**$558,000**
Operation & Maintenance		
1	Annual Labor	$70,000
2	Annual Miscellaneous Maintenance	$5,000
3	Fishway Control Replacement (Annuitized over 15 years)	$17,500
4	Capitalized Cost* (assuming 2 percent interest per year)	$4,625,000
	Total Capitalized Operation & Maintenance Cost:	**$4,717,500**

Table 3-4. Estimated cost for Fish Elevator System

No.	Item	Total Cost
Design and Permitting		
1	Additional Dam Safety Analyses	$150,000
2	Additional Subsurface / Geotechnical Exploration	$100,000
3	Design of fish elevator - Modeling and agency coordination	$100,000
4	Design of fish elevator - Structural	$150,000
5	Design of fish elevator - Mechanical	$80,000
6	Permitting	$200,000
	Total Dam and Sea Wall Rehabilitation	**$8.9 to $10.7 Million**
	Total Design and Permitting for Fish Elevator System:	**$780,000**
	Total Fish Elevator Costs:	**$7,915,500**
	Total Rehabilitation and Fish Passage Structure Costs	**$16.8 to $18.6 Million**

*Capitalized costs are those for future operation and financing of the fish elevator. These costs are captured in current year dollars.

3.1.3.4 Rehabilitate dam, install Fish Passage Structure Summary

A fish elevator structure would provide for potential movement of fish upstream of the existing Ballville Dam, and maintain the historical nature of Ballville Dam, but it does not meet the need for restoring system connectivity and natural hydrologic processes both below and immediately above the dam in the Sandusky River Watershed. While this alternative does not meet all aspects of the purpose and need for the project, it does provide a reasonable alternative for consideration. Table 3-4 provides estimated costs for rehabilitation of the dam and construction of the fish elevator structure.

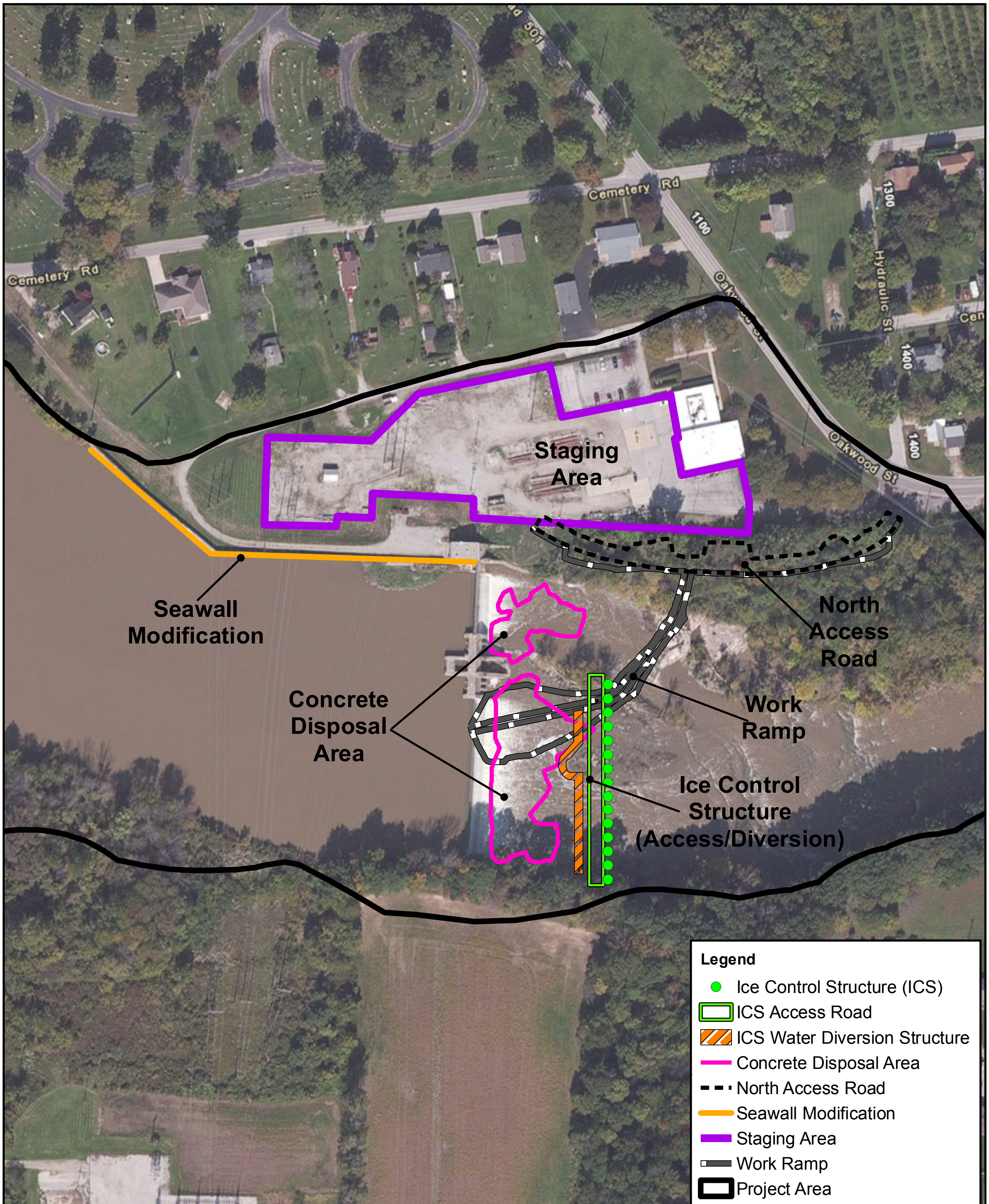
3.1.4 Alternative 3 – Dam Removal with Ice Control Structure

Alternative 3 would be divided into two phases with each phase having multiple objectives for meeting dam removal goals. In summary, the phases are 1.) ice control structure construction, dam removal and restoration; and 2.) sea wall modification and restoration of impoundment area. Figure 3-4 provides location information for Alternative 3. Phases of demolition and construction are discussed in the following sections.

3.1.4.1 Phase 1 – sediment stabilization, dam removal, and ice control structure construction

3.1.4.1.1 *Phase 1A – Construct access ramp below dam (Approximately June – July 2015)*

Demolition equipment would access the dam entirely from the north side of the Sandusky River using the American Electric Power (AEP) storage yard adjacent to the dam. Access to the construction site would be controlled by a lockable double swing gate placed on a temporary fence. Approximately 0.3 acres (0.1 hectares) of wooded riparian habitat would be cleared for development of the access road. The access road would be constructed of clean fill and crushed limestone. Some limited cut and fill would be necessary to meet grade specifications needed for construction traffic. The access road would be constructed to allow for dump trucks, bulldozers, and other construction equipment to access the worksite.



Basemap: ESRI

Alternative 3 - Dam Demolition and Ice Control Structure Construction Area

N W E S

U.S. FISH & WILDLIFE SERVICE

U.S. DEPARTMENT OF THE INTERIOR MARCH 3, 1849

Ballville Dam Project

0 400 800 Feet

Figure 3-4

No refueling of equipment would occur within the Sandusky River. Refueling would only occur within the project staging area (in the AEP storage yard) in order to prevent fuel spills within the waterway.

Once access to the river is established, a temporary work ramp would be constructed to allow access for equipment to reach the top of the south spillway (elevation 625 feet [190.5 meters]). The ramp would be approximately 250 feet (76.2 meters) in length and rise in elevation from 602 feet (183.5 meters) to 620 feet (189 meters) at the dam. Total volume of the ramp is estimated to be 7,400 CY of natural rock, crushed rock and concrete rubble. Maintenance of the ramp and access road within the banks of the Sandusky River may be more frequent than at the entry gates due to rise of water elevation during rain events. However, these are expected to be infrequent due to the location and elevation of the modified impoundment pool. Sediment and erosion control measures would apply as appropriate along the length of the access road and ramp. As demolition of the south spillway and non-overflow portion of the dam occur, the temporary access ramp would be lowered and/or placed in locations to help control grade of the new floodplain bench. The access road from County Road 501 to the work ramp would be removed after Phase 2B however the portion from County Road 501 through the wooded riparian area would remain in place for future access for removal of the debris from the ICS as well as future recreational access.

3.1.4.1.2 *Phase 1B – Construct ice control structures (Approximately August – September 2015)*

Access for construction of the ice control structures (ICS) would be via the access road of Phase 2B, described above. Construction of the ICS would be located 175 feet (53.3 meters) downstream of, and parallel to, the dam. The ICS consists of 15 piers spaced 21 feet (6.4 meters) apart on centers. Overall, the piers would be 25 feet (7.6 meters) tall and six feet (1.8 meters) in diameter. Piers would be embedded approximately 15 feet into the bedrock and extend 10 feet above grade. Exposure above grade would vary based on river bed; however, piers would be uniform in top elevation at 610 feet (185.9 meters) (Appendix A5).

The installation of the ice control structure (ICS) can be performed during modestly active flow conditions anticipated during the low flow annual periods. The Contractor would use best management practices to isolate drill cuttings and prevent concrete from entering the watercourse during installation of the piers. The Contractor would implement water management practices during the installation of the ICS piers to maintain flow in the Sandusky River.

The contractor will access the pier locations using equipment placed directly in the riverbed. During drilling and construction of the piers, river flow will be temporarily diverted around the immediate work area, thereby preventing drill cuttings and concrete from entering the watercourse. It is assumed the contractor will use a large track-mounted drill rig to core bedrock. Drill cuttings may be used onsite for the access ramp to the dam. Concrete for the ICS piers will be delivered from local suppliers using commercial rubber-tired transit mixers.

The riverbed in this area is exposed bedrock with a few areas covered or filled with fine and course sediment. The contractor may require further temporary leveling for equipment access and safe construction. Leveling material, such as sand and gravel, may account for approximately 50 cubic yards of temporary fill within the Sandusky River.

The contractor, in conjunction with the planned access ramp for the dam, would likely build a temporary access road parallel to the entire length of the ICS alignment (Figure 3-1). This road would facilitate access for smaller rubber-tired vehicles and be safer for workers on foot. The road would contain approximately 700 cubic yards of fill, mainly placed within the Sandusky River (540 cubic yards, 0.103 acres). Approximately 80 cubic yards would be placed within Jurisdictional Wetland 18 (0.019 acres) and 80 cubic yards in Wetland 6 (0.015 acres). The access road would be comprised of materials, such as large gravels and cobbles, capable of withstanding river flow. The road may have a low section to pass water flow over the access road surface. Alternatively, a number of conduits may be installed beneath the road to pass expected flows. River diversion may be local to each pier or installed to surround groups of piers as construction proceeds. River flow may be diverted partially, depending upon the location of the work. Flows through main channels would be split around pier worksites within the center of the channel. The particular system used to accomplish this would be the responsibility of the Contractor.

For ICS construction, the contractor would generally follow the below sequence:

1. Create a level access path for the construction equipment (or the equipment would travel on the exposed rock river bed) along the ICS alignment.
2. Install a river diversion system (coffer, water dams, etc.) in order to work “in the dry.”
3. Install drip pans/trays beneath equipment to catch oil and gas leaks.
4. Install a local diversion (sandbags, etc.) at each pier site to guard against cuttings and concrete from entering the water course. Deploy seepage sumps and pumps.
5. Upon completion of construction remove from the river bed any equipment, materials and placed fill.

Each pier would be constructed in three parts: drilling, reinforcement placement, and concrete placement by tremie method (pumping from the bottom up). Each shaft would be drilled approximately 15 feet into the bedrock. A truck mounted drill rig with a 6-foot (1.8 meters) diameter toothed core drum would remove 1 to 3 foot-long (0.3 to 0.9 meter) plugs of bedrock.

Each plug would be extracted and drilling continued until the required depth is attained. After drilling, reinforcement is added. Reinforcement would consist of a six foot diameter circular form and a mesh of rebar assembled for structural strengthening. A cylindrical form for the concrete would extend at least 12 feet above grade to elevation 610 feet (185.9 meters).

Tremie concrete would be used to fill the form, displacing any collected water. The fill volume for each pier would be approximately 26 CY and would be comprised of steel reinforced concrete. The entire ICS (15 piers) would result in nearly 390 CY of poured concrete.

Equipment would be staged in the north staging area and refueled daily at this location. It is estimated that shaft construction, including drilling, reinforcement and concrete placement, could occur at a rate of one pier per day. Concrete placement is likely to occur in groups of five to 10 piers for concrete delivery efficiency. A concrete pump truck and an estimated 40 concrete mixing trucks (roughly three mixer loads per pier) would access the project area via the north access road. After the concrete has hardened the circular forms would be removed exposing the structure.

During the 50 to 75 year service life of the ICS, various maintenance activities would be required to extend each pier's service years. Concrete may experience spalling and abrasion throughout its service life. These areas would be patched with Portland cement grout or epoxy. Routine inspection of the structures would be necessary to ensure that the reinforcement is not exposed and that the concrete is maintained.

Periodic removal of debris that may accumulate on the structure may be necessary. The modified access along the north bank would be kept clear of vegetation for periodical access to the ICS for clearing debris (i.e. limbs and trees) and maintenance.

3.1.4.1.3 *Phase 1C – Remove dam (Approximately September – November 2015)*

After completion of Phase 1A an access road would be in place to begin demolition of the remaining dam. However, it is not until near completion of Phase 1B that demolition would begin. An initial breach of the dam would allow for the impoundment to lower for approximately one week. Afterwards, demolition of the dam occurs until the dam is removed. Demolition of the dam was originally planned to stop at the north abutment where the current carbon feed building is located as described in Appendix A4. However, the City and their contractor may determine it prudent to remove the structure during this phase in the interest of public safety and structural integrity. Demolition is expected to take approximately three months to complete including removal of the Phase 1A access ramp.

Demolition of the dam would be accomplished by a trackhoe (or hoe ram) accessing the top of the dam from the north access way and notching a portion of the dam from elevation 625 to 615 feet (190.5 to 187.5 meters). This notch would allow for an initial dewatering of the impoundment. After a short period of time, the bottom elevation of the notch would be lowered from elevation 615 feet to 610 feet (187.5 to 185.9 meters). This would allow for additional impoundment drawdown to occur while the track hoe-ram demolishes the top of the remaining south spillway. As the south spillway is demolished, additional equipment would work to demolish the non-overflow section of the dam and move northward to demolish the north overflow area. Debris from the demolition would be directed to fall into a two large scour holes downstream of the south spillway and north overflow. The access ramp constructed in Phase 1A would be removed as the dam is reduced in elevation.

The Ballville Dam structure is constructed of approximately 15,000 CY of reinforced concrete consisting of clean concrete materials (approximately 14,000 CY) made from sand and gravel river materials and approximately 800 to 1,000 CY (loose) of steel rebar. During demolition, the contractor would be instructed to only permanently fill with unreinforced concrete into the designated disposal areas (i.e. scour holes). This would require the contractor to separate the steel rebar for offsite disposal. The separation process involves breaking up the larger concrete materials into boulder to cobble size rubble using a jack hammer or hoe-ram and separating the different materials using a claw, front loader, or bull dozer. A bulldozer may be used to push and spread the clean fill materials. An estimated 1,000 CY (loose) of steel rebar and unseparated concrete (i.e. tangled within the rebar) would be hauled offsite for disposal. The cost of hauling would be approximately $10,000.00 (estimated $10.00 per CY). The entire volume of debris from demolition of the dam is estimated to be 15,000 CY. Some of the metal materials in the dam such as the old penstock, sluice gates, and raw water intake apparatus would be removed from the demolition area upon extraction. Approximately 1,900 CY of clean concrete rubble fill from the demolition would remain in the two concrete disposal areas (scour holes) in order to level the river bed.

If the carbon feed building is demolished, it would be demolished using a claw, front loader, or bull dozer. All of the demolition materials would be hauled offsite for disposal.

3.1.4.1.4 *Phase 1D – Channel restoration (Approximately December 2015)*

After demolition of the dam, channel restoration would occur. Restoration of the project area would include approximately 28,000 CY of fill consisting of offsite rock and soil materials as well as some concrete rubble from the demolished dam and leftover access ramp. Any rubble used as fill would be buried with soil. Earth moving equipment such as track hoes, bulldozers, and other equipment would regrade the north bank into a more gradual sloping bank. Stabilization measures would be used to prevent erosion. These measures include seeding and vegetative strategies designed to control invasive plant colonization (Appendix A6).

As restoration is being completed, removal of the remaining temporary ramp from Phase 1A would occur. Minimal permanent access to the river for maintenance of the ICS would remain. Access to the river for motorized vehicles would be controlled by a gate.

3.1.4.2 Phase 2 – Sea Wall modification and restoration of the project area

3.1.4.2.1 *Phase 2A – Monitoring Channel Restoration and Water Supply Intake (Approximately Summer 2016)*

As Phase 1D is being completed, monitoring of the City's reservoir intake, approximately 1.5 river miles (2.4 kilometers) upstream of the dam, would occur to ensure that, during the lowering of the impoundment, no sediment blockage occurs due to instability of upstream banks. Similarly, stability of River Road would be monitored (just southwest of the intersection of River Road and Buckland Avenue) to ensure that no impacts to infrastructure occur as a result of the pool drawdown. If stabilization is necessary, appropriate measures would be implemented to safeguard both the intake and roadway.

3.1.4.2.2 *Phase 2B – Remove any remaining dam material and modify seawall (Approximately October –December 2016)*

After Phase 2A, any material stockpiled in the staging area or along the access road would be removed from the site. The temporary gating would be removed and permanent gate and appropriate signage installed limiting access to the project restoration area.

The last action of the project is to modify the sea wall. The wall is approximately 702 feet (214 meters) long and 1.5 feet (0.5 meters) wide with an average height of five feet. The sea wall would be reduced in height, mechanically, to grade while keeping the below-grade portion in place. Approximately 195 CY of concrete would be removed and disposed of appropriately. Any rebar or other reinforcement would be cut flush with the remaining base. A permanent fence would then be placed atop of the remaining wall to prevent falls from the top of the riverbank. Upon modification of the sea wall and installation of the fencing the project would be completed from a dam removal perspective.

3.1.4.2.3 *Phase 2C – Remove Tucker Dam – if necessary (Approximately Fall 2016)*

Removal of Ballville Dam and pool is expected to expose the Tucker Dam, if present, either whole or in part. The initial notch of the dam in Phase 1C would provide evidence regarding whether the dam may still be in place and its potential to impact the success of the Alternative 3. If the Tucker Dam is intact and requires action, the Programmatic Agreement between the Service, Consulting Parties, and the OHPO provides guidance for removal based on its disposition (Appendix D1). If Phase 1C provides evidence of the structures existence then it would be assessed in order to delineate concerns for safety and effectiveness of the restoration based on its presence. An adaptive strategy may be necessary to assess if removal should occur prior to Phase 2C. If removal is necessary, best management practices would be employed to remove the structure.

3.1.4.2.4 *Phase 2D –Monitoring and Adaptive Management (Multi-year)*

The final phase of the project would occur for multiple years post-removal and would involve monitoring and adaptive management. Monitoring of wetland formation, areas of erosion and deposition, water quality, fish diversity and movement, and mussel relocations would occur to document ecological impacts of dam removal as well as compliance with Section 10/401/404 permits from the USACE and OEPA. Adaptive management could include shaping the floodplain topography to promote the formation of fringe wetlands and/or floodplain wetlands, addressing rilling or gully formation on exposed sediments upstream of the dam, excavation near the reservoir intake to improve flow, or other adaptive actions to address erosion or habitat enhancements as upstream river conditions change.

3.1.4.3 Dam Removal with Ice Control Structure Alternative Estimated Cost Opinion

Alternative 3 would remove the Ballville Dam in two phases, as discussed above. Construction cost opinion is approximately $3.6 million with a 20 percent contingency (Table 3-5). Operation and maintenance costs add an additional $400,000. When considering all aspects of the Proposed Action the total cost opinion is $6,288,216. Additional costs may be incurred if compensatory mitigation for wetland impacts is required as a result of the USACE Section 404/10 permitting process for this alternative. The need for additional compensatory mitigation has not yet been determined, thus a cost estimate has not been generated yet nor included here. There are $2 million awarded by the Service through the Great Lakes Fish and Wildlife Restoration Act to ODNR and approximately $5.8 million awarded by OEPA through the WRRSP program available to carry out this alternative.

Table 3-5. Proposed Action Estimated Cost Opinion

No.	Item	Total Cost
Construction Phase		
1	Mobilization / Demobilization (~5%)	$150,000
2	Portable Sanitation Units	$4,000
3	Project signs	$5,000
4	Stabilize construction access w/culverts	$100,000
5	Concrete hoe-ramming	$1,822,500
6	Concrete Disposal	$126,000
7	Loading out concrete for disposal	$105,000
8	Hauling concrete off site	$52,500
9	Channel tuning with excavator	$60,000
10	Erosion control barrier	$8,000
11	ICS Coffer dam for water diversion	$56,250
12	Floodplain protection (rock or wood bollards)	$12,000
13	ICS Dewatering pump/treatment system	$60,000
14	ICS caissons	$380,000
15	ICS Caisson rock excavation	$353,400
16	ICS Caisson rig mob/demob.	$36,000
17	Steel Reinforcing	$227,130

Table 3-5. Proposed Action Estimated Cost Opinion

No.	Item	Total Cost
18	Topsoil	$21,000
19	Plantings (1 gal)	$25,000
20	Plantings (bare-root seedlings)	$4,000
21	Soil conditioning (limestone)	$1,000
22	Seeding (mechanical)	$60,000
23	Seeding (manual)	$2,500
24	Erosion Control Blanket	$18,900
	Total Construction:	**$3,690,180**
	Construction Contingency (20%)	**$698,036**
Operation and Maintenance (O & M)		
1	North Abutment and Carbon Feed	$200,000
2	Bank Stabilization	$200,000
	Total O & M Cost:	**$400,000**
Design and Permitting		**$1,100,000**
	Total Dam Removal Costs:	**$6,288,216**

3.1.4.4 Dam Removal with Ice Control Structure Summary

Removal of the Ballville Dam, and Tucker Dam if needed, during a single event would meet the purpose and need for the project. It would provide fish passage in both directions, restore system connectivity and natural hydrologic processes in the lower Sandusky River, help achieve aquatic life habitat use-attainment, as well as eliminate the liabilities associated with the existing structure.

3.2 SUMMARY OF KEY ELEMENTS OF ALTERNATIVES CARRIED FORWARD

For comparative purposes, the No Action Alternative (Alternative 1) is evaluated as a baseline condition. Three Action Alternatives, including the Proposed Action, are carried forward for detailed evaluation. All Action Alternatives meet fully, or in part, the purpose and need for the project and are the result of public and agency coordination.

All Action Alternatives would provide for aquatic organism passage upstream of the existing dam location. The Proposed Action and Alternative 3 would also restore connectivity and natural hydrological processes. Additionally, these two alternatives would eliminate liabilities associated with maintenance and operation of a Class I dam by its removal.

Table 3-6. Key Elements of the Action Alternatives

Feature	Proposed Action Incremental Dam Removal	Alternative 1 No Action	Action Alternative 2 Fish Passage Structure	Action Alternative 3 Dam Removal
Provide fish passage	Unobstructed fish passage	No	Use of fish elevator to provide upstream passage	Unobstructed fish passage
Restore river connectivity and natural hydrological processes	Yes	No	No	Yes
Minimize risk of Ice flooding to City of Fremont	Yes, by placement of ice control structure	Yes, by remaining in place	Yes, by remaining in place	Yes, by placement of ice control structure
Eliminate liabilities associated with maintaining the dam	Yes	No	No	Yes
Managing downstream movements of impoundment sediment	Allows for incremental sediment releases and interim sediment stabilization during multiple demolition events over several phases	Some sediment released downstream as result of sluice gate operation.	Some sediment released downstream as result of sluice gate operation.	Allows for sediment release during a single demolition event during one phase
Improved Designated Beneficial Uses (defined by OEPA) for the lower Sandusky River	Yes	No	No	Yes

Table 3-6. Key Elements of the Action Alternatives

Feature	Proposed Action Incremental Dam Removal	Alternative 1 No Action	Action Alternative 2 Fish Passage Structure	Action Alternative 3 Dam Removal
Improving and increasing aquatic habitat availability in the lower Sandusky River downstream of the Ballville Dam site	Yes, improvement would be realized within a year of project completion as less sediment would be released to downstream habitats.	No	Not improved habitat downstream, but potential for increased availability for species which utilize the elevator system	Yes, improvement would be gradual over several years post project completion as sediment is moved downstream.

4.0 Affected Environment

This chapter describes the existing conditions near the Ballville Dam and its area of influence and vicinity. Resources were assessed using different spatial extents depending on the character of the resource and the extent of reasonably foreseeable project-related impacts. This approach is consistent with the Service's regulations implementing NEPA (USFWS 2003). The area of analysis for each resource is documented at the start of its discussion in this chapter.

The Project Area, for the purposes of this chapter, is defined as the area that would be directly affected by the Proposed Action (Figure 1-1). This area would include the physical footprint of the Project facilities and would include workspaces for removal of the dam, access roads, staging areas and new construction areas (i.e. ice control structures). In some cases, potential effects to some resources could extend beyond the Project Area. Therefore, certain resources would be evaluated within a larger segment of the Sandusky River that extends upstream from the Project Area as far as Tiffin, Ohio (the next upstream dam barrier structure) and downstream to include Sandusky Bay. This area is limited to the Sandusky River unless specifically stated otherwise. Figure 4-1 shows the Sandusky River from the city of Tiffin to Sandusky Bay.

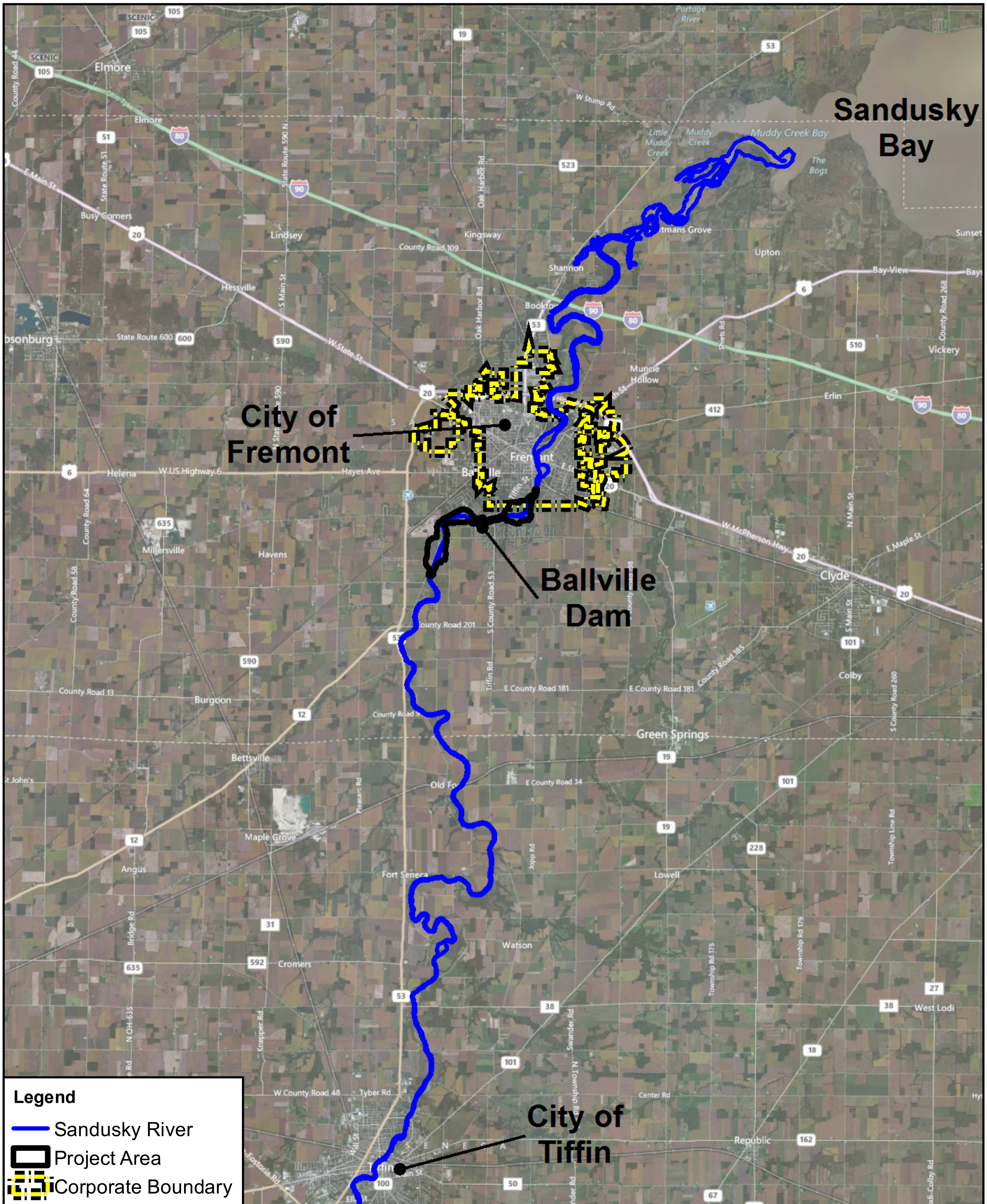
4.1 PHYSIOGRAPHY, GEOLOGY, AND SOILS

4.1.1 Scope of Analysis

This section presents a description of the physiographic region and existing geologic and soil resources known from the region including the Project Area. The geology and soils analysis in this FEIS is based on information from an environmental review conducted for the Project (Stantec 2011b and ASC 2011) and publicly available online databases and/or documents produced by the following federal and state agencies: United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), United States Geological Survey (USGS), Ohio Division of Geological Survey (ODGS), and ODNR.

4.1.2 Existing Conditions

The Ballville Dam and impoundment are located within the Central Lowlands Physiographic Province (ODGS 1998). The Sandusky River headwaters are located in the Glaciated Allegheny Plateaus and pass through the Till Plains and Huron-Erie Lake Plains sections before ultimately flowing into Lake Erie. Locally, the dam and impoundment are within the Maumee Lake Plains Region of Ohio and neighbor the Woodville Lake-Plains Reefs District. The Maumee Lake Plains Region contained the former Great Black Swamp and is characterized as a flat-lying basin with beach ridges, bars, dunes, deltas, and clay flats. It is slightly dissected by streams and has an elevation ranging from 570 to 800 feet (173.7 to 243.8 meters) and a low relief (ODGS 1998).



Basemap: BING

Sandusky River From the City of Tiffin to Sandusky Bay

Ballville Dam Project

0 1 2 Miles

Figure 4-1

The adjacent Woodville Lake-Plain Reefs District is distinguished from the larger region by having low relief (10 feet [3 meters]) lacustrine plain that has low dunes and lake-margin features. It is punctuated by more than 75 ancient bedrock reefs rising 10 to 40 feet (3 to 12.2 meters) above the level of the plain and ranging in area from 0.1 to 3.0 square miles (0.3 to 7.8 square kilometers). Elevation in this district ranges from 600 to 800 feet (182.9 to 243.8 meters) and drains well (ODGS 1998).

A wide expanse of lake bed deposits and a complex series of beach ridges make up the present-day landforms of Sandusky County. The Sandusky River cuts into a large area of lacustrine sand that is surrounded by lake-planed moraine in the Project Area (Pavey et al. 1999). The Columbus Escarpment reaches northward out of Seneca County, crossing Sandusky County along its eastern edge and continuing northward into Lake Erie (ODGS 1998).

Sandusky County sits along the Findlay Arch, an anticline geologic feature[3], separating the Appalachian Basin from the Michigan Basin. The Findlay Arch is primarily Silurian bedrock and is separated from the eastern neighboring Devonian bedrock by the Columbus Escarpment (Coogan 1996). These bedrock systems include the Middle and Lower Devonian Columbus Limestone and Upper and Lower Silurian Salina Group, Tymochtee and Greenfield Dolomites, and Lockport Dolomite.

Sandusky County is approximately 261,888 acres in size (105,982.3 hectares; ASC 2011). Most areas are agricultural with few areas of woodland on the very steep slopes along the Sandusky River and its larger tributaries as well as in undrained areas where the soil is moderately deep to bedrock. The county lies nearly completely in the Hoytville-Nappanee-Paulding-Toledo Soil Region (Prebonick 1996). Within the Project Area, soils along the south bank of the river near the dam are classified as Mentor silt loam, 25 to 50 percent slope. Along the north side of the river near the Ballville Dam the soil classification is Dunbridge sandy loam, 1 to 4 percent slopes. Toledo silty clay loam, ponded and Mentor silt loam, 25 to 50 percent slopes make up the western section of the Project Area (ASC 2011).

4.2 WATER RESOURCES

4.2.1 Scope of Analysis

Water resources that could be affected by the Project extend beyond the Project Area. Therefore, this section presents a description of the water resources within the segment of the Sandusky River that extends from the Bacon Low Head Dam in Tiffin, Ohio and into Sandusky Bay. Water resources include groundwater and surface water. Groundwater is the subsurface hydrologic resource that is used for potable water consumption, agricultural irrigation, and industrial applications and is described in this FEIS in terms of depth to aquifer, aquifer or well capacity, and surrounding geologic composition. Surface water resources described in this

[3] Anticlines are folded rock layers in which the oldest rock lies in the center or core. Most often anticlines are arch shaped.

FEIS include watersheds, streams, wetlands, and floodplains. Discussion of raw water supply from the Sandusky River is presented in Section 4.13 Human Health and Safety.

The water resources analysis in this FEIS is based on information from the Ballville Dam Removal Feasibility Study (Stantec 2011b) and publicly available online databases and/or documents produced by the following federal, state, and local agencies: USGS, Federal Environmental Management Agency (FEMA), ODNR, OEPA, and various Sandusky County agencies.

4.2.2 Existing Conditions

4.2.2.1 Ground Water

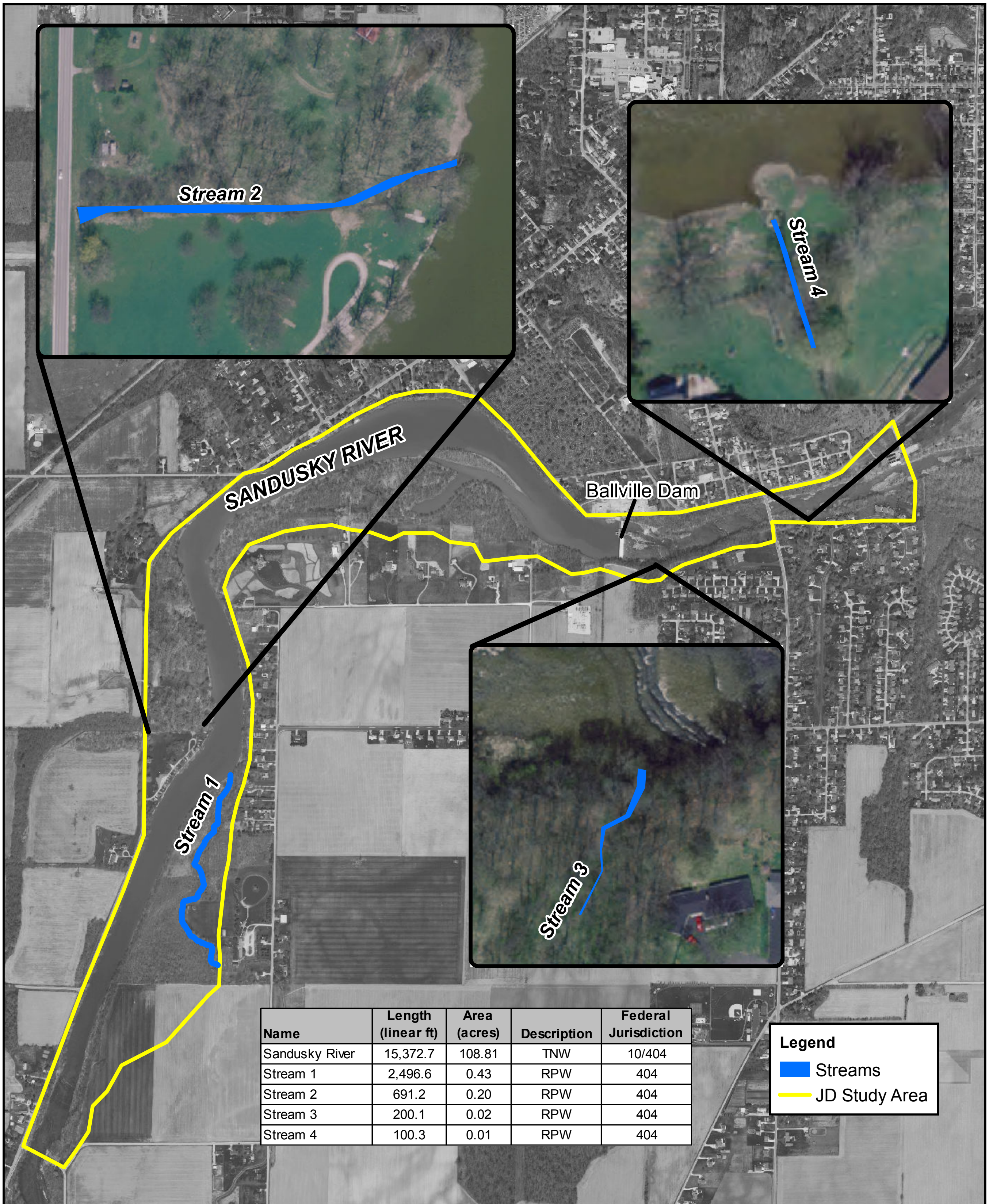
Ground water is a major source of household water in Sandusky County. Approximately 42 percent of households in the County rely on groundwater for household use with nearly 34 percent having private wells and eight percent using public water supplies with ground water as its source. The remaining 58 percent utilize public water supplies derived from surface-water sources (WSOS CAC and Reveille 2003).

A carbonate aquifer of limestone and dolomite is the primary source of ground water in the western portion of the county. Limestone mainly consists of calcium carbonate; dolomite is very similar but contains magnesium carbonate, as well as calcium carbonate. Both are commonly referred to as limestone. Ground water in Sandusky County is regionally recharged in Hancock, Wyandot, and Seneca counties. Ground water in Sandusky County discharges, naturally, to Lake Erie (WSOS CAC and Reveille 2003).

Sandusky County has six political subdivisions that have public water systems, including the City of Fremont. Other towns and cities include: Bellevue, Clyde, Gibsonburg, Green Springs, Lindsey and Woodville. Four of the six public water systems in the County are supplied solely by ground-water sources: Gibsonburg, Green Springs, Lindsey (two wells), and Woodville. Clyde serves its population with surface water from the Raccoon Creek and Clyde reservoirs. The City of Fremont has constructed an above ground surface water reservoir supplied by the Sandusky River to replace the Ballville Dam impoundment as a water supply system (WSOS CAC and Reveille 2003). The new reservoir came online in February 2013.

4.2.2.2 Surface Water

Stream surveys were conducted within the Project Area and, in addition to the Sandusky River, four streams were identified between Tindall Bridge at the upstream end of the impoundment to the west end of the River Cliff Golf Course during August and September 2011 (USACE 2011b; Jurisdiction Determination). This survey identified these four streams as relatively permanent waters (RPW) totaling approximately 3,488.2 linear feet (1063.2 meters) (Figure 4-2), and included 15,372.7 linear feet (4,685.6 meters) of the Sandusky River, a traditional navigable water (TNW) (Table 4-1; USACE 2011b).



Name	Length (linear ft)	Area (acres)	Description	Federal Jurisdiction
Sandusky River	15,372.7	108.81	TNW	10/404
Stream 1	2,496.6	0.43	RPW	404
Stream 2	691.2	0.20	RPW	404
Stream 3	200.1	0.02	RPW	404
Stream 4	100.3	0.01	RPW	404

Streams within the Project Area

N W E S

U.S. FISH & WILDLIFE SERVICE DEPARTMENT OF THE INTERIOR

U.S. DEPARTMENT OF THE INTERIOR MARCH 3, 1849

Ballville Dam Project

0 50 100 Feet

Figure 4-2

Table 4-1. Streams Identified Within the Ballville Dam Project Area

Name	Length (linear ft)	Area (Acres)	Description*	Federal Jurisdiction
Sandusky River	15,372.7	108.81	TNW	10/404
Stream 1	2,496.6	0.43	RPW	404
Stream 2	691.2	0.20	RPW	404
Stream 3	200.1	0.02	RPW	404
Stream 4	100.3	0.01	RPW	404

*TNW=traditional navigable water; RPW=relatively permanent water

The Sandusky River is designated as a State of Ohio Scenic River. This designation ensures that “No state department, state agency, or political subdivision shall build or enlarge any highway, road, or structure or modify or cause the modification of the channel of any watercourse within a wild, scenic, or recreational river area outside the limits of a municipal corporation without first having obtained approval of the plans for the highway, road, or structure or channel modification from the director of natural resources or his representative. The court of common pleas having jurisdiction, upon petition by the director, shall enjoin work on any highway, road, or structure or channel modification for which such approval has not been obtained” (The Ohio Wild, Scenic and Recreational River Act §1517.16).

The Sandusky River begins near the edge of the Glaciated Allegheny Plateaus physiographic region in Crawford County, Ohio and passes through the Till and Lake Plains regions on its way to Sandusky Bay and Lake Erie. Changes in river characteristics can be seen as the Sandusky passes through the Till Plains, near numerous historic lake and glacial boundaries. River meanders are typically a function of till plain irregularities. As the river enters the Lake Plains region, meanders become larger as the floodplains begin to widen. The river is only slightly-to-moderately entrenched, as bed incision has been impeded by substantial areas of limestone and dolomite bedrock. Downstream of the City of Fremont, meanders become more pronounced and irregular as the newer floodplains expand greatly near the bay (Hubbard and Champion, 1925).

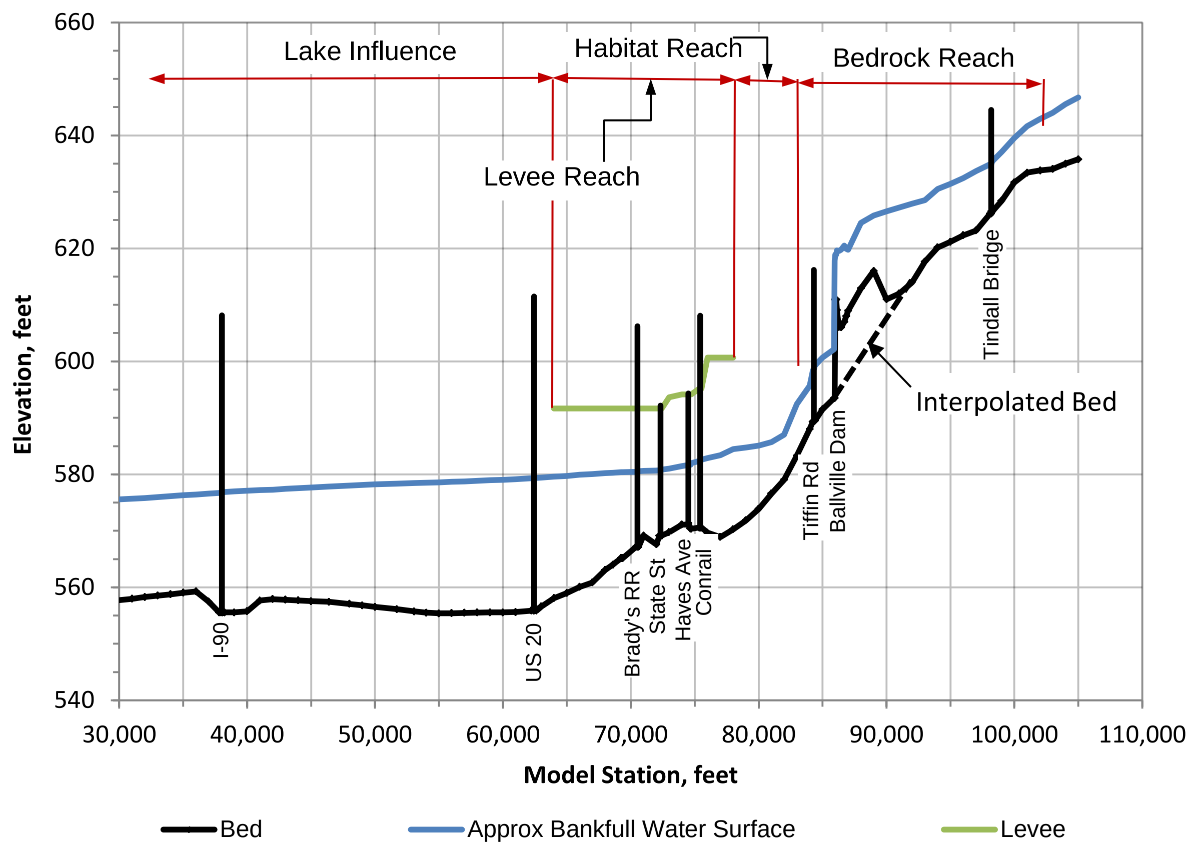
The Sandusky River overall has a smooth longitudinal profile with a mean gradient of 0.14 ft./mi. There is discrepancy regarding the exact location or existence of a waterfall structure thought to historically occur in the vicinity of Ballville Dam, regarding which Stantec has conducted thorough reviews of the current and historic conditions at the site. Small hydraulic drops have been noted in the Sandusky River between Tiffin and Fremont, along with steep bedrock rapids; however, no large drops have been found during Stantec’s current investigations. Observed drops under normal flow conditions were less than two feet. An existing example of this can be observed upstream of Tindall Bridge and as noted in historical literature and maps (Von Shon 1908). A review of historic photographs at the dam site during construction as well as upstream along Buckland Ave prior to construction do not indicate the presence of a waterfall with a drop on the order of 8 to 10 feet (2.4 to 3 meters). In addition, a geotechnical investigation was performed within the impoundment in 2010 by the AECOM Company under the direction of the USACE (AECOM 2010). Various penetrations were performed from immediately behind the dam to the upper end of the island. Top of rock elevations from these efforts also did not indicate the presence of historic bed drops greater than is typical. To date, Stantec was unable to locate any current or historical evidence that a waterfall of significant magnitude existed at the Ballville Dam site or within its current impoundment. Although this feature has been mentioned in texts (Evans et al. 2002; Trautman 1975; and Howe 1851), these are not first-hand accounts and no reference is given to support or verify their existence. It is possible that reference to a waterfall of this size may be referring to the steep bedrock rapids present between the Tindall Bridge area and downtown Fremont.

Near the Ballville Dam and impoundment the channel characteristics and slopes vary (Figure 4-3). Upstream of the impoundment, the channel is dominated by bedrock substrate with some interstitial gravel and cobble. The bedrock has limited channel incision, creating wide cross sections with width to depth ratios (W/D) between 50 and 60. Here, the channel is only slightly entrenched and floodplain access is generally excellent. Slopes are relatively steep (0.002 feet/ 1foot [0.0006 meters / 0.3 meters]) in the bedrock sections and high velocities exist in those areas. The same characteristics exist immediately below the dam, except that the channel is more entrenched. This condition changes as the stream gains distance past the Tiffin Road Bridge constriction and becomes less laterally confined. It is anticipated that channel bed characteristics within the impoundment would match those up and downstream.

As the river passes the Tiffin Road Bridge, gravel and cobble material become more prevalent in the substrate composition. Frequent side and mid-channel bars composed of these materials are observed from just past the bridge down to the large left-hand bend adjacent to the River Cliff Golf Course (Figure 4-3). Bedrock still dominates as grade control through this reach, but increased water depths are seen locally, such as just upstream of the old hydro facility. Field survey indicated a hydraulic slope of 0.003 feet / 1foot (0.0009 meters / 0.3 meters). Just downstream of the discontinued hydroelectric powerhouse generating facility, the valley expands substantially. The main channel of the river narrows to approximately half of the width observed upstream of the dam impoundment, as flow is diverted to distributaries (i.e. side channels) in the forested area along the right bank. The inside of the left-hand bend is also comprised of frequent divergent channels. These channels are less stable and are formed and altered due to the presence of massive amounts of driftwood and debris that have gathered during flood events.

Immediately downstream of the river left bend at the golf course, the river characteristics change substantially. This geomorphic reach extends from the golf course to the north side of the City of Fremont. Its most prominent feature is the levee and flood wall system finished in 1972, which laterally confines the river and forms an entrenched channel. Besides a narrow section adjacent to Roger Young Park (Figure 4-3), the base-flow channel width is generally 350 to 400 feet (106.7 to 121.9 meters). Depth ranges vary throughout the reach, with the deepest portion at the narrow levee constriction. The flood walls in this reach eliminate floodplain access and are designed to protect against a 50,000 cfs flood event with some freeboard. While the river bed slope is relatively high, bankfull water surface slope (0.0008 feet / 1 foot [0.0002 meters / 0.3 meters]) is greatly reduced due to backwater effects from the lake-level impacts downstream. Substrates range from bedrock to clay size particles, with a predominance of sand and fine gravel.

Figure 4-3. Profile of Sandusky River Between I-60 and Tindall Bridge



From Stantec 2011

The remainder of the river to the Bay is flat (0.0002 feet / 1 foot [0.00006 meters / 0.3 meters]). Channel width increases in the direction of the bay, with distances between banks frequently reaching greater than 1,000 feet (304.8 meters) near the mouth. There is excellent floodplain connectivity in the majority of the reach except where dikes have been built. As the river nears the transition to Muddy Creek Bay, it begins to resemble a marsh ecosystem. The heavy suspended sediment load from the watershed begins to fall out and create major sedimentation. There is less channel definition and widespread deposition of fine particles with frequent islands. Dikes around private lands at the mouth provide some physical definition between marsh and active channel. These river flow characteristics have historically affected navigation and dredging is still needed for some vessels. Dredging in this area has been a common practice since 1867 (United States Secretary of War 1880) and delta-like conditions have been noted at the mouth of the river at least as far back as 1880.

4.2.2.2.1 *Floodplain and Flooding Events*

FEMA has sponsored Flood Hazard Boundary maps for Sandusky County. These maps provide approximate floodplain boundaries on select reaches of the county's rivers and streams. Approximate floodplain limits do not provide detail as to the specific flood elevations or discharge values along the mapped reach. Approximate floodplain delineations are generally created using historical information or empirical discharge/channel capacity ratings. Channel elevations and measurements are taken from the USGS 7.5-minute quadrangle topographic maps or the best available maps for a given location.

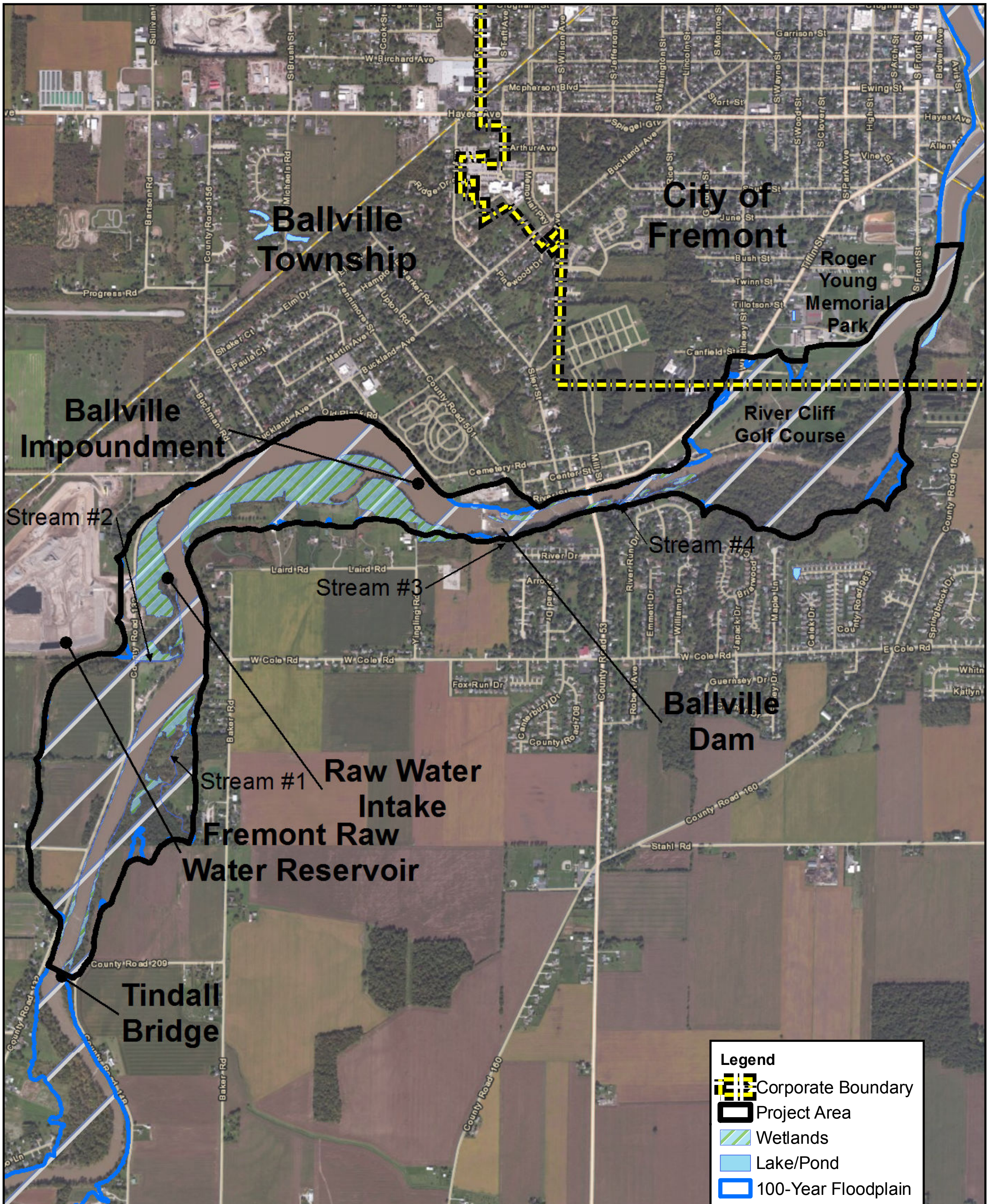
The floodplain designation is generally regarded as the natural limits of runoff inundation resulting from a designated 100-year flood event. This is the area around streams and rivers that would be under water when a 100-year flood event occurs. The 100-year flood event is used to map floodplains for regulatory purposes. For floodplain conditions and impacts referenced in this FEIS, the 100-year flood event is the referenced flood. Figure 4-4 shows the extent of the floodplains within the Project Area.

"Floodway" is defined as the channel of a river or streams and those portions of the floodplain adjoining the channel which are reasonably required to efficiently carry and discharge the peak flow of the regulatory flood of any river or stream. Floods in Sandusky County are not uncommon. According to records, floods were recorded in 1821, 1847, 1860, 1863, 1879, 1883, 1884, 1904, 1910, 1912, 1937, 1959, and 1963 (Sandusky County Scrapbook 2011), many of these causing noteworthy damage within the City. The flood of record occurred in 1913 with an estimated peak discharge of 63,500 cfs. Flood stage has been reached in subsequent years, but the addition of flood protection measures has limited impacts in the City. Floodwalls constructed by the USACE in 1972 are designed to contain discharges exceeding 50,000 cfs with some freeboard. Many historical flood events were due to ice jams in the river downstream of Fremont.

Although storm flooding has been documented, it is the combined influence of storms and ice floes that have the greatest potential for flood damage. A full account of ice jam and related flooding research in Fremont was performed by CRREL of the U.S. Army Engineer Research and Development Center in two reports (USACE 2008 and 2011a).

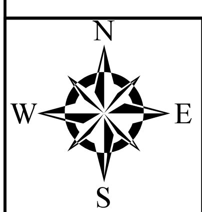
Fremont is located near the boundary of lake level influence on the Sandusky River. The low gradient, low energy section of the river from the City to the bay facilitates the accumulation of ice and formation of ice jams. Surface ice, typically formed in flat sections of the river, and frazil ice, typically formed in steep sections of the river, originate upstream and become trapped as the river transitions into the low-gradient lake influenced areas. As ice accumulates, upstream water levels are artificially elevated, increasing the chance of flood damage.

These same processes at work in the lower river are present in the Ballville Dam impoundment, although on a smaller scale. The surface of the impoundment freezes due to the slower water velocity near the upper end of the impoundment and creates a barrier to the downstream floe of ice. The jam point is located approximately 1.7 miles (2.7 kilometers) upstream from the dam approximately where River Road (CR 132) begins to run parallel to the river.



Basemap: ESRI

Floodplains and Wetlands within the Project Area



Ballville Dam Project

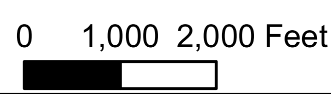


Figure 4-4

Six major ice jam related flood events have caused damage to the City. Four events, in 1833, 1843, 1883, and 1904, occurred before the Ballville Dam was completed in 1913. Two events, in 1959 and 1963, occurred after the dam was built but before the flood walls were constructed in 1972. No ice related flood events have caused damage in Fremont since the flood walls were built. Two major floods in 1978 (36,000 cfs) and 2007 (22,300 cfs) occurred when there was potential for ice jams and ice jamming was recorded upstream of Ballville Dam without reported flood damage in Fremont (USACE - 2008 and 2011a).

4.2.2.3 Wetlands

A wetland delineation study was conducted by the USACE during August and September 2011 (USACE 2011b). The study encompassed an area from Tindall Bridge at the upstream end of the impoundment to the west end of the River Cliff Golf Course (USACE 2011b). This study and a subsequent approved jurisdictional determination identified twenty jurisdictional wetlands within the study area totaling approximately 63.37-acres (Table 4-2; USACE 2011b; Appendix A9). Figure 4-4 provides the locations of wetlands within the Project Area.

Table 4-2. Wetlands Identified Within the Ballville Dam Project Area

Name	Area (Acres)	Description	Federal Jurisdiction	ORAM Score
Wetland 1	6.29	Emergent/Scrub-Shrub/Forested	10/404	71.5 (Category 3)
Wetland 2	0.04	Emergent/Scrub-Shrub/Forested	404	71.5 (Category 3)
Wetland 3	0.19	Emergent/Scrub-Shrub/Forested	404	71.5 (Category 3)
Wetland 4	34.11	Emergent/Scrub-Shrub/Forested	10/404	71.5 (Category 3)
Wetland 5	2.47	Emergent/Scrub-Shrub/Forested	10/404	71.5 (Category 3)
Wetland 6	0.08	Emergent/Scrub-Shrub	10/404	46.5 (Category 2)
Wetland 7	0.02	Emergent	10/404	44.5 (Modified 2)
Wetland 8	0.9	Emergent/Scrub-Shrub/Forested	10/404	68.5 (Category 3)
Wetland 9	0.18	Emergent/Scrub-Shrub/Forested	10/404	68.5 (Category 3)
Wetland 10	0.04	Emergent/Scrub-Shrub/Forested	10/404	68.5 (Category 3)
Wetland 11	0.55	Emergent/Scrub-Shrub	10/404	68.5 (Category 3)
Wetland 12	0.05	Emergent/Scrub-Shrub	10/404	68.5 (Category 3)
Wetland 13	1.68	Emergent/Scrub-Shrub/Forested	10/404	42.5 (Modified 2)

Table 4-2. Wetlands Identified Within the Ballville Dam Project Area

Name	Area (Acres)	Description	Federal Jurisdiction	ORAM Score
Wetland 14	2.47	Emergent/Scrub-Shrub/Forested	10/404	75 (Category 3)
Wetland 15	10.89	Emergent/Scrub-Shrub/Forested	10/404	75 (Category 3)
Wetland 16	1.23	Emergent/Scrub-Shrub/Forested	10/404	52 (Category 2)
Wetland 17	0.09	Emergent	10/404	14.5 (Category 1)
Wetland 18	0.19	Emergent/Scrub-Shrub/Forested	10/404	68.5 (Category 3)
Wetland 19	1.87	Emergent/Scrub-Shrub/Forested	10/404	68.5 (Category 3)
Wetland 20	0.03	Emergent/Scrub-Shrub/Forested	10/404	68.5 (Category 3)

4.2.2.4 Water Quality

4.2.2.4.1 *Designated Beneficial Uses*

Water bodies within the State of Ohio have, by law, designated beneficial uses that are protected by water quality standards. Examples of designated uses include drinking water, industrial water supply, and aquatic life use. Streams in Ohio are categorized by various indices as either exceptional warm water habitat, warm water habitat, or modified warm water habitat (Table 4-3).

Table 4-3. Ohio EPA Aquatic Life Use Designations for Ohio Streams (2011)

Biological Criteria	IBI[1] (Boat)	MIwb[2] (Boat)	ICI[3] (Boat)
Exceptional Warm Water Habitat	48	9.6	46
Warm Water Habitat	34	8.6	34
Modified Warm Water Habitat	20	5.7	22

[1]Index of Biotic Integrity
[2]Modified index of well being
[3]Invertebrate Community Index

Within the Project Area and the segment of the Sandusky River both upstream and downstream of the Project Area, the Sandusky River's Aquatic Life Use Standard is Warm Water Habitat. It has also been designated for Public Water Supply, Agricultural Water Supply, Industrial Water Supply, and Primary Contact Recreation. In practice, water quality standards based on aquatic life use criteria are often the most difficult to attain. The Sandusky River was sampled at eight locations between river miles 5.5 and 23.0 in 2009. Table 4-4 illustrates OEPA narrative criteria for Aquatic Life Use in the Huron Erie Lake Plain as well as the performance of sample locations in the Sandusky River with respect to those standards.

Nitrate levels in the Sandusky River at the City of Fremont's intake exceeded safe drinking water standard limits on numerous occasions. Finished water samples, collected between 2004 and 2008, exceeded the 10 mg/L criterion in 17 of 128 samples (OEPA 2011b). The City has constructed a raw water reservoir that allows for the withdrawal and storage of water and alleviates the nitrate issues with water supply from the river. The new raw water supply became operational in 2013.

Table 4-4. Sample Location and Aquatic Life Use Attainment Status in the Sandusky River Based on Sampling from OEPA (2011)

Locality	River[a] Mile	IBI (Boat)	MIwb[b] (Boat)	ICI[c] (Boat)	Status	Cause of Impairment
Sandusky River upstream of Wolf Creek	23.0	55	10.2	52	Full	-
Sandusky River upstream of County Road 35	21.3	54	9.7	58	Full	-
Sandusky River upstream of Portage Trail Park	19.0	44	8.0*	-	Partial	Siltation and direct habitat alteration
Sandusky River upstream of Ballville Dam	18.05	35[ns]	7.2*	<u>6</u>*	Non	Siltation and direct habitat alteration
Sandusky River at Fremont, upstream of Roger Young Park	16.8	41	9.9	34	Full	-
Sandusky River at Fremont at State Street	15.4	38	9.7	G	Full	-
Sandusky River opposite Fremont Yacht Club	12.8	<u>26</u>*	9.2	--	Non	Siltation and Nutrient Eutrophication (Biological Indicators)
Sandusky River upstream of Wightmans Grove	5.5	32	8.7	<u>14</u>	Non	Siltation, Nutrient Eutrophication (Biological Indicators), Embedded Substrates.

a - River Mile (RM) represents the Point of Record (POR) for the station, not the actual sampling RM.
b - MIwb is not applicable to headwater streams with drainage areas < 20 mi2.
c - A narrative evaluation of the qualitative sample based on attributes such as EPT taxa richness, number of sensitive taxa, and community composition was used when quantitative data was not available or considered unreliable. VP=Very Poor, P=Poor, LF=Low Fair, F=Fair, MG=Marginally Good, G=Good, VG=Very Good, E=Exceptional
* - Indicates significant departure from applicable biocriteria (>4 IBI or ICI units, or >0.5 MIwb units). Underlined scores are in the Poor or Very Poor range.
Ns – Nonsignificant departure from biocriteria (>4 IBI or ICI units, or >0.5 MIwb units).

4.2.2.4.2 *Water Chemistry*

Sediment and nutrient loads in the Sandusky River are high due in part to agricultural land uses in the Sandusky River basin. Ambient nutrient loads from the basin cause concern due to their potential to influence water quality in Lake Erie. Excessive nutrients, especially phosphorus, contribute to the formation of harmful algal blooms (HAB's).

These HAB's in Lake Erie can be attributed to six to seven species of cyanobacteria but *Planktothrix spp.* and *Lyngbya wollei* are two types of particular concern because of their abundance in recent years. Explosive growth of HAB's may degrade water quality, affect the aesthetic qualities of nearshore environments, limit recreational opportunities, and negatively alter the structural characteristics of aquatic habitats. Cyanobacteria may produce neurotoxins that affect the nervous system, hepatotoxins that affect liver function, and dermotoxins that may cause allergic skin reactions. One toxin called Microcystin is harmful to humans when ingested in drinking water or through direct contact. Microcystin has been observed in Lake Erie at concentrations of approximately 60 parts per billion (ppb), far above accepted standards for drinking water (1.0 ppb) and recreational contact (20 ppb; LEMNST 2011). In addition to toxicity issues, the HAB's may also form extensive, foul smelling mats along the shoreline. *Lynbya wollei*, believed to be a recent invader of the Great Lakes, was observed to produce a mat of approximately 200 metric tons along only 100 meters of shoreline (Bridgeman and Penamon 2010). Algal blooms were observed in the Ballville Dam impoundment in 2010 and 2011.

The proliferation of HAB's has been attributed to nutrient enrichment from anthropogenic sources. HAB's are less able to compete with desirable forms of algae when phosphorus concentrations are below 5 ppb (LEMNST 2011). Further, their growth appears to be controlled by seasonal fluctuations in temperature with optimal growth occurring in the 25° to 30° Celsius (C) range and threshold temperatures for blooms greater than 15° C. Consequently, most HAB's occur in late summer or early fall. Chaffin (2009) also observed that the spatial pattern of Microcystis blooms was spatially coincident with turbidity plumes from Maumee Bay. Loading from the surrounding tributaries is the largest source of phosphorus for Lake Erie. The Maumee River and the Detroit River together account for 93 percent of the total phosphorus (TP) load to the western Lake Erie Basin (Limnotech 2010). However, the Sandusky River was not included in their analysis. Comparison of data presented in the Limnotech report and the data generated at the Heidelberg water quality monitoring station indicate that, while smaller, the Sandusky River is a substantial source of nutrients to Lake Erie (Table 4-5). Loadings from the Sandusky on a per square mile basis are one to three times greater than those from the Maumee River.

Table 4-5. Nutrient Loading Comparison (metric tons/year) for the Detroit, Maumee, and Sandusky Rivers[1]

Parameter	Detroit	Maumee	Sandusky
Mean Annual Flow (cfs)	172,000	7,000	1,075
Basin Area (mi^2)	*	6,330	1,251
Total Suspended Solids (TSS)	1,540,800	1,360,800	633,747
Total Phosphorus (TP)	2,968	1,175	688
Soluble Reactive Phosphorus (SRP)	885	391	174
Nitrate/Nitrite	57,454	25,802	13,153
Total Kjeldahl Nitrogen (TKN)	29,032	6,371	3,007

[1]Data for the Detroit River and Maumee River from 2004 - 2005 (Limnotech 2010) and data for Sandusky River 2004 - 2005 (Heidelberg Gage)
*not available

River discharge, suspended solids, and nutrient concentrations all exhibit some degree of seasonality with high concentrations coinciding with the wetter parts of the year (Figure 4-5). The Ballville Dam, because of its low trapping efficiency, has little or no effect on water flow or nutrient transport. The high load seasons tend to occur during the cooler parts of the year when HABs are less likely to occur. Nonetheless, the annual mean SRP concentration of 0.47 ppm is well above the 5 ppb number thought to favor more desirable forms of algae (LEMST 2011).

4.2.2.4.3 *Sediment Quantity*

Most sediment delivered by the Sandusky River Watershed is comprised of fine-grained particles and is transported as wash or suspended load. These fine suspended sediments are, in general, no longer being stored behind the dam. These highly mobile, fine particles are washing over the dam suspended in the water column. Coarse-grained particles transported as bed load continue to be trapped by the dam at the upstream end of the impoundment as the water velocity slows when entering the impounded area. . The long-term replenishment of spawning substrates downstream of the impoundment depends on deposition of these coarse-grained particles and habitat replenishment is compromised by this process.

The impoundment has been accumulating and storing sediment since its completion in 1913. Recent sediment studies presented in Stantec (2011b) suggest that the dam is approaching, or has reached an equilibrium state where very little new material is stored directly behind the dam despite the high volumes of sediment delivered from the watershed. Estimates of sediment depths range from 11 feet near the water intake at the dam to over 20 feet near some outer margins.

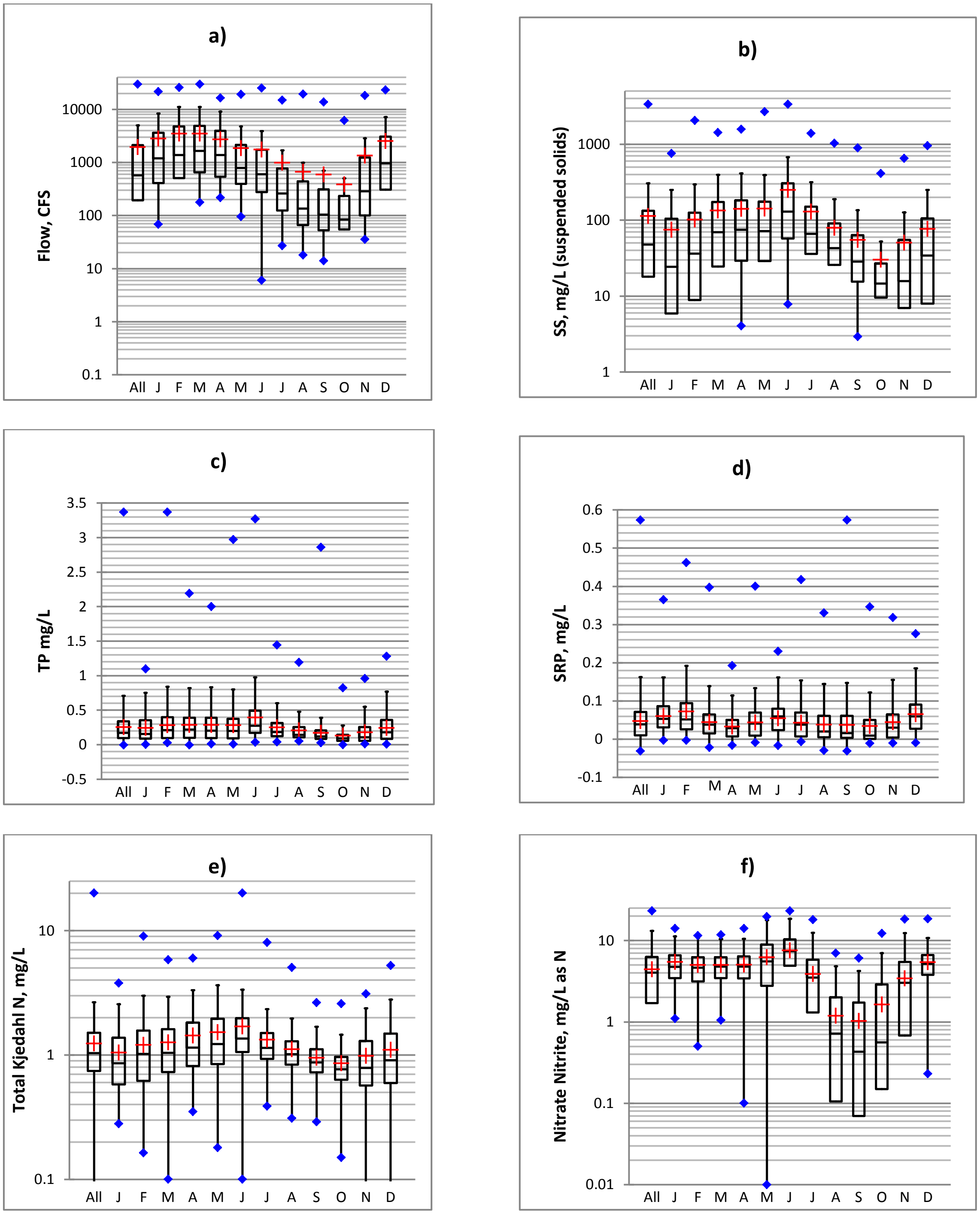
The total volume of stored sediment is currently dominated by the supply of fine sediment from the watershed. The entrainment threshold for these particles is very low and some material is exported out of the reservoir with each storm event while new material from the watershed is stored. Thus the reservoir is at equilibrium. Coarse material is not easily entrained and cannot be passed over the dam. Given sufficient time, coarse materials would eventually displace stored fine sediment. However, because supply of coarse-grained sediment from the watershed is low this process would require thousands of years and would occur on a geologic timeframe.

Coarser sediments such as coarse sand and gravel are continuing to be trapped by the dam at the upstream end of the impoundment as the water velocity slows. This pattern of deposition and settling of coarse sediment was noted by Evans et al. (2002): the sediment texture is 5:10:85 ratio of gravel:sand:silt near the dam and 20:20:60 at the upstream end of the impoundment.

A partially defined channel has remained within the impoundment sediment based on photos and multiple bathymetric surveys. The island within the impoundment has formed within the last 30 years as sediment has continued to build a point bar on the inner portion of the river bend upstream of the dam. Its formation has promoted further deposition on the south shore downstream of the island. Only one documented drawdown has occurred since the dam’s use was converted from electric generation to water supply; this was performed in 1969 to allow for repairs and modifications to the dam, intake, and sluice systems.

Fluvial sediment data from the USGS gage used in the Feasibility Study (Stantec 2011b) analysis was taken from the 1979-2002 period in order to capture the most recent land use and watershed characteristics. Data indicate that suspended sediment concentrations and loading were seasonally variable. Concentrations are highest during peak spring flow and agricultural activity months of April, May, and June. Monthly means for daily concentrations were higher than 50 mg/l in every month but September, October, and November. Peaks of the daily concentrations were greater than 500 mg/l in every month but October and the highest observed concentration was 2,420 mg/l. The monthly means were substantially higher than monthly medians, an indication that a small number of very high concentrations (i.e., storm generated events) influence the mean. Daily sediment loads followed a similar seasonal pattern. Loading is highest during the wet season from February to May and the maximum observed load was 124,000 tons in a single day. Samples taken by the USGS at this location indicate that approximately 97 percent of the suspended sediment is composed of silt or clay sized particles (less than 0.0625mm), regardless of discharge.

Figure 4-5. Seasonal Discharge (a) and Water Chemistry Concentrations in the Sandusky River at Heidelberg Gage



(Period of record is from 1950 – 1956 and 1978 to 2002. Total suspended solids (b), total Phosphorus (c), soluble reactive Phosphorus (d), total Kjedahl (e), and Nitrate + Nitrite (f).)

Evans et al. (2002) estimated that approximately 1.3 million cubic yards of sediments exist behind the dam, mostly fine silts. A recent bathymetric study by Stantec (2011b) estimated a sediment quantity of just 840,000 cubic yards. This difference is likely attributed to inclusion of the land above normal pool water surface (i.e. the new island) when considering volumes in the Evans et al. (2002) report. Historic maps show impounded water surface areas larger than current extents. It is important to note that much of the depositional area above normal pool is now covered with mature vegetation and is unlikely to mobilize even when the dam is removed. Therefore, the estimate of 840,000 CY of sediment is appropriate when considering potentially mobile sediment. The difference in estimated sediment volume could be due to the following items: different survey methods; different comparison area; sediment addition/loss due to hydrology (i.e. big flow events in the spring of 2010); or interpretation of the pre-dam topography (10-foot contour intervals).

4.2.2.4.4 *Sediment Quality*

A wide variety of organic compounds and metals are continuously discharged into rivers from industrial, agricultural, and urban sources. Contaminants carried in runoff are adsorbed onto suspended particles and eventually settle to the sediments. Currently, there are no standard criteria or screening levels that can reliably predict when contaminants in sediment might exert toxic effects on the benthic community that lives in the sediments, or, indirectly affect human health. Sediment quality guidelines such as Threshold Effects Levels (TELs) and Probable Effect Levels (PELs) are used to predict when the chemical concentrations found in sediment may be acceptable but both TELs and PELs are based on short-term, laboratory run, toxicity tests, primarily conducted with sediment dwelling organisms (e.g. amphipods and midges) using field-collected sediments that typically contain complex mixtures of contaminants. The values of TELs and PELs are predictive and not directly associated with in-stream toxicity (Smith et al. 1996; USGS 2000).

To improve the ability of sediment quality guidelines to actually predict toxicity in field-collected sediments, consensus-based Probable Effect Concentrations (PECs) were developed by MacDonald et al. (2000). Consensus-based PECs were developed using a database from across North America and have been used to reliably predict toxicity of sediments on a regional basis, including the Great Lakes basin (MacDonald et al. 2000). Ohio-specific Sediment Reference Values (SRVs) were developed to identify representative background sediment concentrations for lotic (flowing) water bodies. SRVs were developed using a regional reference site approach that accounts for differences between Ohio’s five ecoregions. The SRVs presented in Table 4-6 are for the Huron-Erie Lake Plateau ecoregion, where Ballville dam is located (OEPA 2008, USEPA 2000).

Sediment analysis was conducted by Evans and Gottgens (2007) on Ballville impoundment sediment and included analysis for metals, pesticides, polychlorinated biphenyls (PCBs), and semi-volatile organic compounds, including polycyclic aromatic hydrocarbons (PAHs). No PAHs were detected. Table 4-6 presents a comparison of the concentrations of metals and DDT breakdown products (e.g. 4,4-DDD and 4,4-DDE) detected in Ballville impoundment sediment compared to several sediment quality guidelines.

Table 4-6. Concentrations of metals and DDT breakdown products detected in Ballville Impoundment sediments (from Evans and Gottgens 2007)

Parameter	Minimum Detected Conc. (mg/kg)	Maximum Detected Conc. (mg/kg)	Average Sediment Conc. (mg/kg)	Threshold Effects Level[1] (mg/kg)	Probable Effects Level[2] (mg/kg)	Consensus Based Probable Effects Conc.[3] (mg/kg)	Huron-Erie Lake Plateau Sediment Reference Value[4] (mg/kg)
Aluminum	46,600	51,900	48,933.33	26,000	60,000		42,000
Arsenic	12.60	14.20	13.43	5.90	17	33*	11
Chromium	44	52	47	37.30	90	111*	51
Iron	31,000	34,000	32,766.67	19,000	25,000		44,000
Lead	35	35	35	35	91.30	128*	47[7]
Nickel	32	33	32.67	15.90[8]	42.80[8]	48.6*	36
Zinc	124	135	130.67	123	315	459*	190
4,4-DDD[5]	7.70	10.80	9.67	3.54	8.511	28	
4,4-DDE[6]	7.30	7.30	7.30	1.42	6.752	31.1*	

[1]Threshold Effect Levels (TELs) are sediment concentrations below which adverse effects are expected to occur only rarely (Smith et al. 1996).

[2]Probable Effect Levels (PELs) are sediment concentrations above which adverse effects in sediments are expected to frequently occur (Smith et al. 1996; USGS 2000).

[3]Probable Effect Concentrations (PECs) are consensus-based sediment concentrations above which harmful effects are likely to be observed; MacDonald et al. 2000a. An "*" designates a reliable PEC (>20 samples and >75% correct classification as toxic.

[4]Sediment Reference Values (SRVs) identify representative background sediment concentrations for lotic (flowing) water bodies in Ohio (Ohio EPA 2008).

[5]Value for sum of p,p'-DDD and o,p'-DDD.

[6]Value for sum of p,p'-DDE and o,p'-DDE.

[7]State-wide Sediment Reference Value.

[8]MacDonald et al. 2000.

None of the maximum detected concentrations of metals or DDT breakdown products exceeded consensus-based PECs. Additionally, iron, lead, nickel and zinc were found below the appropriate SRV. The maximum detected concentration of chromium also approximates background reference conditions as represented by the SRV.

A consensus-based PEC is not available for aluminum and the maximum detected concentration of aluminum exceeded the Ohio-specific SRVs. Aluminum silicates were found to be abundant in the fine-grained clay soils surrounding the Ballville impoundment.

A comparison of the metal concentrations in Ballville sediments, normalized for aluminum, to those in recent Lake Erie sediments indicate metal concentrations in the Ballville impoundment sediments are appreciably lower than the concentrations reported from Lake Erie sediments (Evans and Gottgens 2007).

4.3 WILDLIFE AND FISHERIES

4.3.1 Scope of Analysis

This document describes the existing wildlife and fisheries resources that occur within the Project Area and within the larger section of the Sandusky River and its riparian borders within the Project Area. Additionally, it considers aquatic species that could potentially occur from the Bacon Low Head Dam in Tiffin, Ohio downstream to Sandusky Bay. This section does not discuss rare, threatened, or endangered wildlife species as these species are discussed in Section 4.4 in this FEIS.

The wildlife and fisheries analysis in this FEIS is based on data from the ODNR Division of Natural Areas and Preserves (DNAP) Natural Heritage Database (2011); OEPA fisheries surveys of the Sandusky River; site-specific biological surveys; and publically available literature for the region. In order to establish baseline information regarding wildlife use in the vicinity of the project and to evaluate the potential impacts from construction and operation of the project, a number of wildlife studies were conducted (Stantec 2011b) according to survey plans that were developed in coordination with ODNR and Service, which are summarized in the following sections.

4.3.2 Existing Conditions

4.3.2.1 Terrestrial Wildlife

The Project Area lies within the Eastern Corn Belt Plain Ecoregion. In addition, most of Ohio, including Sandusky County and the Project Area, is part of the Beech-Maple Forest Region). The Beech-Maple Forest Region is dominated by Beech (*Fagus grandifolia*) and Sugar Maple (*Acer saccharum*); however, extensive tracts of Elm-Ash-Maple (*Ulmus* spp.-*Fraxinus* spp.-*Acer* spp.) type forests occur in depressions and areas between glacial moraine flats, reaching into the area of the former Great Black Swamp (Braun 1950). The bogs and prairies that are scattered throughout the area increase the vegetation diversity of the Beech-Maple region. The Great Black Swamp was drained in the late 1800’s to promote agriculture and reduce malarial outbreaks. Natural streams and channelized drainage ditches are abundant throughout the area. Braun (1950) stated that the “treeless areas” of the old surveys, old bogs and prairies increased the vegetation diversity of the Beech-Maple Region.

There is little publically available information specific to the Project Area regarding the occurrence and abundance of Neotropical migratory birds. Sandusky County is part of the Lake Plain physiographic region where Peterjohn and Rice (1991) found breeding bird records averaged 73.4 species per breeding bird block (n=95) with a high of 112 and a low of 52. Records of migrants in the project vicinity are associated with the overall western basin of Lake Erie and those counties bordering Lake Erie. Several studies indicate the importance of migrant stopover sites is directly correlated to the size of the particular habitat (Ewert et al. 2006; Guarnaccia and Kerlinger 2007). The Sandusky River drainage is designated as an Important

Bird Area (IBA) by the Audubon Society for a number of bird uses including large number of migrating landbirds (Ritzenthaler 2008).

A total of 84 species of mammals are listed by the American Society of Mammologists as having records from the State of Ohio (ASM 2012). Of these records, 41 are listed as “common” within the state and approximately 38 potentially occur in northwestern Ohio. Those potentially occurring include the opossum, rabbits, bats, 16 rodents (i.e. beaver, voles, and squirrels), coyote, fox, raccoon, river otter, skunk, weasel, mink and white-tailed deer (ASM 2010).

Ten species of bat are likely to occur in Ohio (Brack et al. 2010). Bats generally roost in trees during spring, summer, and fall and in winter either migrate to caves, mines, or man-made structures to hibernate, or migrate south to warmer climates to overwinter. Ohio has approximately 47 species and subspecies of reptiles statewide. These include lizards, snakes, and turtles. Sandusky County has records for one lizard, nine snakes (none of which are venomous), and four turtles (ODNR 2008).

Forty eight amphibian species occur in Ohio. These include newts, mudpuppy, hellbender, salamanders, toads, and frogs. One mudpuppy, three salamanders, two toads, and seven frogs occur in Sandusky County according to ODNR (2012c).

4.3.2.2 Aquatic Wildlife

4.3.2.2.1 *Fish*

In July 2011, OEPA reported results of fish sampled at river miles 15.4, 16.8, 18.5 (located within the Ballville Dam impoundment), 19.5, 21.3, and 23.4 (7). In total, 45 species were collected. Species richness was highest at River Mile 16.8 (n = 30) and lowest at River Mile 18.5 (n = 15) (Table 4-7). Three species classified as “intolerant” (OEPA 1989) to water quality degradation were collected in the surveys: Greater Redhorse, River Redhorse, and Black Redhorse (*Moxostoma erythrurum*). The Greater Redhorse (Ohio threatened) was collected both above and below the Ballville impoundment. Common Carp (*Cyprinus carpio*), Goldfish (*Carassius auratus*), Ghost Shiner (*Notropis buchanani*), and White Perch (*Morone americana*), all non-native species, were collected during the surveys. Carp were especially abundant and comprised a major proportion of the biomass at all sites surveyed. The Freshwater Drum (*Aplodinotus grunniens*), an important host species for freshwater mussels, was collected downstream but not upstream of the dam.

Table 4-7. Fish Species by River Mile (OEPA 2011a)

Common Name (*Species Name*)	**River Mile**						**Total**
	15.4	**16.8**	**18.5**	**19.5**	**21.3**	**23.4**	
Black Redhorse (*Moxostoma duquesnei*)					18	128	**146**
Golden Redhorse (*Moxostoma erythrurum*)	105	94	30	52	151	46	**478**
Greater Redhorse (*Moxostoma valenciennesi*)	3	1		1	2	1	**8**
N. Hog Sucker (*Hypentelium nigricans*)				1	14	16	**31**
Quillback (*Carpiodes cyprinus*)	11	16	5	2	2		**36**

Table 4-7. Fish Species by River Mile (OEPA 2011a)

Common Name (*Species Name*)	River Mile						Total
	15.4	16.8	18.5	19.5	21.3	23.4	
River Redhorse (*Moxostoma carinatum*)		3	1		2	6	**12**
Shorthead Redhorse (*Moxostoma macrolepidotum*)		4					**4**
Silver Redhorse (*Moxostoma anisurum*)	4	9		3	4	14	**34**
Smallmouth Buffalo (*Ictiobus bubalus*)	10	30					**40**
Spotted Sucker (*Minytrema melanops*)			25	26			**51**
White Sucker (*Catostomus commersonii*)				4			**4**
Bigmouth Buffalo (*Ictiobus cyprinellus*)		2					**2**
Black Crappie (*Pomoxis nigromaculatus*)		1					**1**
Bluegill (*Lepomis macrochirus*)	7	1	1	4			**13**
Green Sunfish (*Lepomis cyanellus*)	2		5	6			**13**
Green X Bluegill (*L. cyanellus X L. macrochirus*)	3	3	8	9			**23**
Green X Pumpkinseed (*L.cyanellus X L. gibbosus*)				1			**1**
Largemouth Bass (*Micropterus salmoides*)			5	6			**11**
Orangespotted Sunfish (*Lepomis humilis*)	10	4	43	35	5		**97**
Pumpkinseed (*Lepomis gibbosus*)				1			**1**
Rock Bass (*Ambloplites rupestris*)				1	13	29	**43**
Smallmouth Bass (*Micropterus dolomieu*)	5	7		1	12	25	**50**
White Crappie (*Pomoxis annularis*)		4	2	1			**7**
Gizzard Shad (*Dorosoma cepedianum*)	56	15					**71**
Bluntnose Minnow (*Pimephales notatus*)		9	3	9	7	2	**30**
Carp (*Cyprinus carpio*)	5	81	15	25	12	18	**156**
Emerald Shiner (*Notropis atherinoides)*	19						**19**
Ghost Shiner (*Notropis buchanani*)							
Golden Shiner (*Notemigonus crysoleucas*)			1	3			**4**
Goldfish (*Carassius auratus*)	16						**16**
Sand Shiner (*Notropis stramineus*)	10	8		1	14	5	**38**
Spotfin Shiner (*Cyprinella spiloptera*)	3	53	31	62	22	34	**205**
Spottail Shiner (*Notropis hudsonius*)	1						**1**
Suckermouth Minnow (*Phenacobius mirabilis)*						1	**1**
Northern Pike (*Esox lucius*)		1					**1**
Brown Bullhead (*Ameiurus nebulosus*)		2	7				**9**
Channel Catfish (*Ictalurus punctatus*)	1	36			10	21	**68**
Flathead Catfish (*Pylodictis olivaris*)		1					**1**
Yellow Bullhead (*Ameiurus natalis*)				2		1	**3**
Longnose Gar (*Lepisosteus osseus*)	5	13					**18**
Logperch (*Percina caprodes*)	1	4			13	10	**28**
Yellow Perch (*Perca flavescens*)	1	1					**2**
Freshwater Drum (*Aplodinotus grunniens*)	18	30					**48**

Table 4-7. Fish Species by River Mile (OEPA 2011a)

Common Name (*Species Name*)	River Mile						Total
	15.4	16.8	18.5	19.5	21.3	23.4	
White Bass (*Morone chrysops*)	13	3					**16**
White Perch (*Morone americana*)	1	1					**2**
Total	**310**	**446**	**182**	**256**	**301**	**357**	**1852**

4.3.2.2.2 *Mussels*

Several limited mussels surveys within the project area have occurred recently. A survey within the impounded area near the new raw water reservoir intake was conducted in 2010 (EnviroScience 2010a). No live or dead mussels were found within the survey area, however, one live giant floater (*Pyganodon grandis*) was found approximately 100 feet (30.5 meters) downstream. Stantec (2011b) surveyed areas from immediately below the dam to the Hayes Avenue Bridge on September 1 and 2, 2011 (Appendix A10. Eighty-one live animals comprising twelve species and one additional species as a weathered valve were observed (Table 4-8). No federally listed taxa were found. However, one live three-horn wartyback (*Obliquaria reflexa*; Ohio Threatened) and 23 deertoe (*Truncilla truncata*; Ohio SOC) were observed. The surveyed area was characterized as having exceedingly poor habitat (i.e. cobble and boulders, exposed bedrock) for freshwater mussels (Stantec 2011b).

Table 4-8. Species Count and Condition for 2011 Mussel Surveys, Sandusky River Below Ballville Dam, Sandusky County, Ohio

Species	Common Name	Live	Fresh Dead	Weathered	Subfossil
Actinonaias ligamentina	Mucket	1			
Amblema plicata	Threeridge	1			1
Lampsilis cardium	Pocketbook	1			
Lasmigona complanata	White Heelsplitter	19		5	
Lasmigona costata	Fluted Shell	2		2	
Leptodea fragilis	Fragile Papershell	2			
Obliquaria reflexa	Three-horn Wartyback	1			
Potamilus alatus	Pink Papershell	19		4	
Pyganodon grandis	Giant Floater	3		2	1
Quadrula pustulosa	Pimpleback	1			
Quadrula quadrula	Mapleleaf	8	3	2	1
Strophitus undulatus	Creeper			1	
Truncilla truncata	Deertoe	23		7	1
Total		**81**	**3**	**23**	**4**

4.3.2.2.3 *Macroinvertebrates*

OEPA (2011a) conducted macroinvertebrate sampling in the Lower Sandusky River watershed in 2009. Eight sampling locations were selected for monitoring from downstream from Wolf Creek (RM 22.73) to the head of Sandusky Bay (RM 0.0). Upstream from Fremont (RM 21.30), macroinvertebrate indices scored in the exceptional range (ICI=58) (OEPA 2011a). The OEPA Report (2011a) indicates, "The Ballville Dam impounds the river within the city of Fremont. Sampling of the dam pool predictably yielded depressed biological sampling results due to siltation and habitat alteration… the macroinvertebrate community was in poor condition at RM 18.05. Downstream from the Ballville Dam the next two sites, RMs 17.70 and 15.40, were in full attainment." ICI scores for these reaches are presented in Table 4-4.

4.3.2.2.4 *Invasive Species*

Nearly 200 non-native species have become established in the Great Lakes ecosystem and, on average, a newly established invader is discovered in the basin every eight months (Great Lakes Restoration Commission 2005). Successfully established invasive species such as the Sea Lamprey and the Quagga mussel have profoundly altered the structural and functional elements of the ecosystems they colonized. As a consequence, globally important habitats have been fundamentally altered, sensitive or rare species are threatened with extinction, and social and commercial interests have been irreparably damaged.

An undetermined number of invasive species currently occupy habitats within the project vicinity. Species such as the Common Carp and the Asiatic Clam (*Corbicula fluminea*) are established invaders and would not be easily eradicated. Other known species currently at risk to invade, such as the Silver Carp (*Hypophthalmichthys molitrix*) and Bighead Carp (*H. nobilis*), may potentially colonize the Great Lakes and connected waters. It is difficult to predict what species may be the next to colonize, although tools such as invasive species risk assessments can help us to better anticipate and plan for future invasions.

4.3.2.2.5 *Established Invaders*

A cursory review of available data revealed that the non-native species in Table 4-9 are relatively well established in the project vicinity.

Table 4-9. Non-native Species and Approximate Great Lakes Invasion Date

Species	**Invasion Date**
Common Carp (*Cyprinus Carpio*)	1879
White Perch (*Morone americana*)	1950s
Reed Canarygrass (*Phalaris arundinacea*)	unknown
Honeysuckle (Lonicera spp.)	1800s
Purple Loosestrife (*Lythrum salicaria*)	1869
Zebra Mussel (*Dreissena polymorpha*) / Quagga Mussel (*Dreissena rostriformis*)	1988-1989
Asiatic Clam (*Corbicula fluminea*)	1980

Ghost Shiner (*Notropis Buchanani*)	1979

Source: Mills et al. 1994 and Holeck et al. 2004

4.3.2.2.6 *Potential Invaders*

Additional species have invaded the Great Lakes and associated water bodies at an astonishing rate over the past century (Strayer and Dudgeon 2010). It is difficult to predict, with any certainty, which of these species would be the next to colonize successfully and which would fail to materialize in the vicinity of Ballville Dam. Discussion in the following sections is limited to two of the known threats to Great Lakes aquatic ecosystems that may reasonably occur in the project vicinity.

Sea Lamprey. One of the most damaging of the Great Lakes invaders, Sea Lamprey, has yet to become established in the Sandusky River (Coldwater Task Group 2011). The Sea Lamprey first entered the Great Lakes in the 1830s and later accessed Lake Erie through the Welland Canal system in 1921 (Trautman 1981). In the adult lifestage, Sea Lampreys are parasitic and attach to, and feed off, of large bodied fish including Lake Trout (*Salvelinus namaycush*), Steelhead (*Oncorhynchus mykiss*), and Burbot (*Lota lota*) among others. The Lake Trout population crash in Lakes Huron, Superior, and Michigan coincided with the establishment of Sea Lamprey (Smith 1973). Several methods for controlling the spread of these animals are currently in place. They include: Lampricide (chemical treatment of streams to kill larval Sea Lampreys); barriers; and trapping.

The Sea Lamprey Control Program (SLC), through the Service and Great Lakes Fishery Commission, work to reduce populations using the above actions. SLC also maintains records relating to spawning tributaries in the Great Lakes to help identify suitable Sea Lamprey habitat and provide review and comment relating to range expansion when barrier removals are proposed around the Great Lakes Basin. This helps them to lend their expertise and ensure barrier removals do not inadvertently allow for the expansion of Sea Lamprey populations. According to their review of this project as it relates to Sea Lamprey concerns:

"… We fished an adult Sea Lamprey trap at the dam in 2001 and did not capture any. While there is Lamprey spawning and larval habitat present up and downstream of the dam, we have never found any larval Sea Lampreys or native Lampreys up or downstream of the dam. The lower portion of the river is a large estuary with low flow which may deter entrance into the river. Overall, there was not enough evidence to suggest that Sea Lampreys would become a problem in the river …"

Following up on their previous work, SLC sampled near the mouth of the Sandusky River on June 6-7, 2012 using granular bayluscide plots. No Sea Lamprey were captured during this sampling event, further supporting their opinion related to potential suitability of Sea Lamprey habitat in Sandusky River.

Asian Carp. Four species of Asian Carps (Bighead, Silver, Grass (*Ctenopharyngodon idella)*, and Black Carp *(Mylopharyngodon piceus)*) are present in the Mississippi and Ohio River Basin, and are moving closer to the Great Lakes watershed (Abdusamadov 1987; Jennings 1988). Historically, between the years 1995 and 2000, three live Bighead Carp were captured in western Lake Erie, although none have been captured since. More recently, July 31 – August 4, 2012, water samples from Sandusky Bay and River (near Fremont, Ohio) and Maumee Bay indicated positive results for Silver Carp Environmental DNA (eDNA) (ODNR 2012a; ODNR 2012b). Samples of eDNA were collected in June 2013 in both the Maumee River and the Sandusky River, and although all samples taken in the Sandusky River were negative, one sample from the Maumee River was positive for Silver Carp DNA (ODNR 2013e).

Environmental DNA is one tool used to sample the environment and can help managers determine the presence of species specific DNA in the water. However, there are many possible eDNA vectors, in addition to live individuals, which could explain its presence including bird feces, boats or equipment used in multiple water bodies, contaminated sewage outputs, etc. (United States 2013, USACE 2013). With this in mind, the detection of Asian Carp eDNA in a water body suggests only that DNA is present, but it does not conclusively indicate the presence of live individuals. For example, linkages between the Wabash and Maumee River basins (i.e., Eagle Marsh and Grand Lake St. Mary's) may offer potential routes of entry to the Great Lakes as do illicit introductions or unintentional bait transfers, however, there may also be a number of other important vectors to consider.

There is widespread concern that Asian Carps, if able to colonize the Great Lakes, could potentially disrupt food webs and threaten sport and commercial fisheries (GLRC 2005). To investigate the associated risk relating invasive Asian Carp species to Ballville Dam, a risk analysis process was completed. The risk analysis consisted of an in-depth evaluation by expert panelists intended to evaluate two key elements relating Asian Carps to the Ballville Dam:

- Risk of establishment of Asian Carp species (Silver Carp, and/or Bighead Carp, and/or Grass Carp, and/or Black Carp), in the Sandusky River and Lake Erie, via various pathways, and

- Potential impacts, of an established population[s] of Asian Carps, on the Sandusky River and Lake Erie.

To complete this analysis, a panel of eleven experts was formed. Individuals were selected based on their expertise and knowledge related to the technical questions that formed the basis of the review, and in a manner to ensure broad representation of the various entities engaged in Asian Carp prevention in Lake Erie and the Sandusky River. The risk analysis was completed based on anticipated impact on fish passage of each alternative, No Action, Fish Passage Structure, and Dam Removal with Ice Control Structure or Incremental Dam Removal with Ice Control Structure. The results of this analysis are detailed in Chapter 5 - Environmental Consequences, Sections 5.3.2, 5.3.3, 5.3.4, and 5.4.5, respectively. Also, the complete Risk Analysis Summary Report can be found as Appendix E.

4.4 RARE, THREATENED, AND ENDANGERED SPECIES

4.4.1 Scope of Analysis

The species analysis in this FEIS considers plant and animal species that are federally-listed as threatened, endangered, candidate, proposed, and species of concern; species that are state-listed as threatened, endangered, species of concern, and species of special interest; and/or species that receive specific protection defined in federal or state legislation. This analysis considered species that could potentially occur within the Sandusky River and its riparian borders within the Project Area. Additionally, it considers aquatic species that could potentially occur from the Bacon Low Head Dam in Tiffin, Ohio downstream to Sandusky Bay. The rare, threatened, and endangered species analysis in this FEIS is based on information from Ballville Dam Removal Feasibility Study (Stantec 2011b), species surveys conducted for the project, and coordination with federal and state agencies including ODNR's Natural Heritage Database (2011b), Service comments (2012), OEPA's fisheries surveys of the Sandusky River, Ohio State University Bivalve Database, and other publicly available online databases and/or documents regarding biological data for the region.

4.4.2 Existing Conditions

Nine species were identified by the Service that are known or likely to occur within Sandusky County, and may occur near the Project Area based on the *Federally Listed Species by Ohio Counties* (Service 2014):

1) Eastern Prairie Fringed Orchid (*Platanthera leucophaea*); federally threatened
2) Indiana Bat (*Myotis sodalis*); federally endangered
3) Kirtland's Warbler (*Setophaga kirtlandii*); federally endangered
4) Piping Plover (*Charadrius melodus*); federally endangered
5) Rayed Bean (*Villosa fabalis*); federally endangered
6) Eastern Massasauga (*Sistrurus catenatus*); federal candidate
7) Rufa red knot (*Calidris canutus rufa*); proposed threatened
8) Northern long-eared bat (*Myotis septentrionalis*); proposed endangered
9) Bald Eagle (*Haliaeetus leucocephalus*); federal species of concern

A total of 13 state listed species were identified by the ODNR as potentially occurring in or near the Project Area (ODNR 2011a).

1) Indiana Bat; state endangered

2) Piping Plover; state endangered
3) Kirtland's Warbler; state endangered
4) Bald Eagle; state threatened
5) Rayed Bean; state endangered
6) Eastern Massasauga; state endangered
7) Western Banded Killifish (*Fundulus diaphanous menona*); state endangered
8) Bobcat (*Lynx rufus*); state endangered
9) American Bittern (*Botaurus lentiginosus*); state endangered
10) King Rail (*Rallus elegans*); state endangered
11) Northern Harrier (*Circus cyaneus*); state endangered
12) Trumpeter Swan (*Cygnus buccinators*); state endangered
13) Greater Redhorse (*Moxostoma valenciennesi*); state endangered

Six other species were identified through searching records found online at www.dnr.state.oh.us. Their inclusion is warranted due to either historic or current records not identified by resource agencies. These species are:

1) River Redhorse (*Moxostoma carinatum*); state species of concern
2) Threehorn Wartyback (*Obliquaria reflexa*); state threatened
3) Deertoe (*Truncilla truncata*); state species of concern
4) Purple Wartyback (*Cyclonaias tuberculata*); state species of concern
5) Kidneyshell (*Ptychobranchus fasciolaris*); state species of concern
6) Round Pigtoe (*Pleurobema sintoxia*); state species of concern

The Ohio State University Bivalve database indicates that the following rare mussel species have been found in the Sandusky River:

1) Northern Riffleshell (*Epioblasma torulosa rangiana)*; federally endangered
2) Rayed Bean; federally endangered
3) Black Sandshell (*Ligumia recta)*; state threatened

4) Kidneyshell; state species of concern

5) Round Pigtoe; state species of concern

6) Wavy-rayed Pocketbook (*Lampsilis fasciola)*; state species of concern

7) Purple Wartyback; state species of concern

However, most of these records were found prior to 1976, with some found as recently as 1995. Furthermore, most of the historical records are from no closer than approximately 20 miles (32.2 kilometers) upstream of the project location.

Of these 25 species, seven are not expected to occur near the Project area due to lack of suitable habitat, range reduction, or because they are only transient within the region: bobcat, piping plover, American bittern, king rail, Rufa red knot, Northern riffleshell, and eastern massasauga rattlesnake (Table 4-10).

Table 4-10. List of Federal and State Listed Species Potentially Occurring at the Project

Species	General Habitat Description	Occurrence in Project Vicinity
Eastern Prairie Fringed Orchid	Found in wet prairies, sedge meadows, and moist road-side ditches.	No records within the Project Area. However, known populations occur in Riley Township, Sandusky County east of Project Area.
Indiana Bat	Winter hibernacula are in caves and abandoned mines and summer roosts are in trees.	No winter habitat is present in the vicinity of the project. Potential summer habitat exists within and nearby the Project Area.[1]
Northern Long-eared Bat	Winter hibernacula are in caves and abandoned mines and summer roosts are in trees.	No winter habitat is present in the vicinity of the project. Potential summer habitat exists within and nearby the Project Area.[9]
Bobcat	Variety of habitat from forested mountain areas to lowland swamps.	As of 2011, no verified sightings have been recorded from Sandusky County. **Not expected to occur in the Project Area**.[2,3]
Bald Eagle	Nests in large trees near lakes, reservoirs, rivers.	Nests occur approximately 1 mile (1.6 kilometers) upstream (Portage Livery Nest) within the vicinity of the project and a second nest located approximately 1 mile downstream (Fremont Nest) of the vicinity of the project. Other locations upstream and downstream along the Sandusky River.[2]

Table 4-10. List of Federal and State Listed Species Potentially Occurring at the Project

Species	General Habitat Description	Occurrence in Project Vicinity
Piping Plover	Sandy beaches along Lake Erie and other interior reservoirs	Does not nest in Ohio. No records from the vicinity of the project. No suitable nesting or migration stopover habitat within Project Area. **Not expected to occur in the Project Area**.[2]
Kirtland's Warbler	Nests in Jack Pine habitat in Michigan and Wisconsin. Migration stopover habitat includes shrub/scrub and forested areas.	Does not nest in Ohio. No records from the vicinity of the project. However, suitable migratory stop-over habitat is present within Project Area.[2]
Rufa Red Knot	Does not nest in Ohio, but migratory stopover habitat includes sand, gravel, or cobble beaches, and mudflats along the shore of Lake Erie.	Does not nest in Ohio. No suitable migration stop-over habitat because the project is not adjacent to Lake Erie. **Not expected to occur in the Project Area.**
American Bittern	Large undisturbed wetlands that have scattered small pools amongst the dense vegetation. They occasionally occupy bogs, large wet meadows, and dense shrubby swamps.	Records exist within Sandusky County. Habitat is not present in the vicinity of the project. No records from the vicinity of the project. **Not expected to occur in the Project Area**.[2,4]
King Rail	Large cattail marsh and wetland complexes and their margins.	Records exist within Sandusky County. Habitat is not present in the vicinity of the project. No records from the vicinity of the project. **Not expected to occur in the Project Area**.[2,4]
Northern Harrier	Large contiguous grasslands, marshes, low intensity agriculture and pasture/hayfields.	Records exist within Sandusky County. No records from the vicinity of the project. May occur as a transient along the periphery of the vicinity of the project.[2,4]
Trumpeter Swan	Large marshes and lakes ranging in size from 40 to 150 acres.	Records exist within Sandusky County. No records from the vicinity of the project. May occur as a transient within the vicinity of the project.[2,4]
Greater Redhorse	Medium to large rivers in the Lake Erie drainage system of Ohio.	Records occur upstream and downstream of the Ballville Dam within the vicinity of the project.[2]
River Redhorse	Only the largest rivers of the Ohio and Lake Erie drainage systems.	Records occur upstream and downstream of the Ballville Dam within the vicinity of the project.[5]

Table 4-10. List of Federal and State Listed Species Potentially Occurring at the Project

Species	General Habitat Description	Occurrence in Project Vicinity
Western Banded Killifish	Areas with an abundance of rooted aquatic vegetation, clear waters, and with substrates of clean sand or organic debris free of silt.	Records occur within the lower Sandusky watershed.[2,6]
Rayed Bean	Smaller headwater streams, shoal or riffle areas with gravel and sand substrate, and shallow, wave-washed areas of lakes.	Historic records occurring within the Sandusky River watershed. No records from 2011 survey in the vicinity of the project.[1,7] **Not expected to occur in the Project area.**
Threehorn Wartyback	Large rivers in sand or gravel; may be locally abundant in impoundments	Historic records occurring within the Sandusky River watershed. One record from 2011 survey in the vicinity of the project. [7,8]
Deertoe	Medium to large rivers in mud, sand, or gravel	Historic records occurring within the Sandusky River watershed. Twenty three live animals were located during a 2011 survey in the vicinity of the project. [7,8]
Purple Wartyback	Medium to large rivers in gravel or mixed sand and gravel	Historic records occurring within the Sandusky River watershed. No records from 2011 survey in the vicinity of the project. [7,8]
Kidneyshell	Medium to large rivers in gravel	Historic records occurring within the Sandusky River watershed. No records from 2011 survey in the vicinity of the project. [7,8]
Round Pigtoe	Medium to large rivers in mud, sand, or gravel	Historic records occurring within the Sandusky River watershed. No records from 2011 survey in the vicinity of the project.[7,8]
Northern Riffleshell	Medium to large rivers in sand or gravel	Historic records occurring within the Sandusky River watershed, but far upstream from project area. No records from 2011 survey in the vicinity of the project.[7,8] **Not expected to occur in project area.**

Table 4-10. List of Federal and State Listed Species Potentially Occurring at the Project

Species	General Habitat Description	Occurrence in Project Vicinity
Black Sandshell	Medium to large rivers in sand or gravel.	Historic records occurring within the Sandusky River watershed, but far upstream from project area. No records from 2011 survey in the vicinity of the project.[7,8] **Not expected to occur in project area.**
Wavy-rayed Pocketbook	Small to medium rivers in sand or gravel	Historic records occurring within the Sandusky River watershed, but far upstream from project area. No records from 2011 survey in the vicinity of the project.[7,8] **Not expected to occur in project area.**
Eastern Massasauga	Wetlands, wet prairie, or nearby woodland or shrub edge habitat. Occurs seasonally in shallow wet lowlands and drier upland areas with gasses and forbs.	Habitat is not present in the vicinity of the project. No records from the vicinity of the project. **Not expected to occur in the Project area.**[2]

*Listing Status: FE = Federally Endangered, FT = Federally Threatened, FC = Candidate for Federal Listing, FSC = Federal Species of Concern, SE = State Endangered, ST = State Threatened Indiana Bat; SSOC = State Species of Concern.
1 Source: Service correspondence, May 2, 2012
2 Source: ODNR correspondence, February 10, 2011
3 Source: ODNR website: 2011-12 Wildlife Population Status Report
4 Source: Ohio Breeding Bird Atlas II website: preliminary results
5 Source: OEPA 2011a: Biological and Water Quality Study of the Lower Sandusky River Watershed
6 Source: Trautman 1981; the Fishes of Ohio
7 Source: Watters et al. 2009; The Freshwater Mussels of Ohio
8 Source: Stantec 2011b
9 Source: EnviroScience 2010a

4.4.2.1 Federally Threatened, Endangered, Candidate, and Proposed Species and Species of Concern

No federally-listed threatened or endangered species are known to occur near the Ballville Dam and impoundment (Project Area; ODNR 2011a and USFWS 2012b). The Project lies within the geographic ranges of four Federal endangered species (Indiana bat, rayed bean mussel, piping plover, and Kirtland's warbler); one Federal threatened species (eastern prairie fringed orchid); one candidate species for Federal listing (eastern massasauga rattlesnake); one Federal species of concern, the bald eagle and; two species proposed for Federal listing, the Northern long-eared bat and Rufa Red Knot (USFWS 2012a).

The piping plover and Rufa Red Knot are transient shorebird species during migratory seasons throughout Ohio (ODNR 2011a). No records for these species are known from within the Project Area, and no suitable habitat for these species exist in the Project Area. There are no known records of the eastern massasauga rattlesnake in the vicinity of the Project Area (ODNR 2011a). In addition, no appropriate habitat for these species was identified within or adjacent to the Project Area. Only four records for the Northern Riffleshell mussel exist from the Sandusky

River, the most recent is from 1976 and from locations more than 20 miles upstream of the project area. The following sections discuss the six species that have the greatest potential to occur in or near the Project Area.

4.4.2.1.1 *Eastern prairie fringed orchid*

The Project Area lies within the range of the federally threatened eastern prairie fringed orchid. This tall, showy orchid is found in wet prairies, sedge meadows, and moist road-side ditches.

There are no current records of eastern prairie fringed orchid within the Project Area, however known populations occur in Riley Township, Sandusky County, located just east of the Project Area. This is known from nearby populations including the State of Ohio's largest at Pickerel Creek State Wildlife Area, and smaller populations in Riley Township.

A survey for the eastern prairie fringed orchid was completed by Stantec and Service biologists on June 20, 2013 within wetland areas in and around the Ballville Dam and Sandusky River within the project area. Overall habitat for the orchids at all the sites visited was marginal to poor due to the extensive forest cover in most areas, and the invasive cover of Reed canarygrass in open areas. No orchids were observed within any of the project area. Based on the survey results and the habitat present within the area to be impacted, it is unlikely that the orchid would occur within the project area.

4.4.2.1.2 *Indiana Bat*

The Project Area lies with the range of the federally endangered Indiana bat. Since first listed as endangered in 1967, their population has declined by nearly 60 percent. Several factors have contributed to the decline of the Indiana bat including the loss and degradation of suitable hibernacula, human disturbance during hibernation, White-nose Syndrome, pesticides, loss and degradation of forested habitat, particularly stands of large, matures trees. During winter, Indiana bats hibernate in caves and abandoned mines. Summer habitat requirements of the species are not well defined but the following are considered important: dead or live trees and snags with peeling or exfoliating bark, split tree trunk and/or branches, or cavities, which may be used as maternity roost areas; live trees with exfoliating bark; and stream corridors, riparian areas, and upland woodlots which provide foraging sites (Service 2007).

There are no current records of Indiana bats from the Project Area. The closest record is approximately 12 miles (19.3 kilometers) southeast of the project area in Seneca County. An Indiana bat survey was conducted during June 2010 approximately 6,000 river feet (1,828.8 meters) upstream of the Ballville Dam near the raw water intake for the raw water reservoir. A total of three bats representing two species (two little brown bats-*Myotis lucifugus*; one big brown bat-*Eptesicus fuscus*) were captured during two nights of netting. No Indiana bats were captured (EnviroScience 2010b).

There are approximately 109 acres (44.1 hectares) of forest within the Project Area (Table 4-11). Forested areas generally provide suitable roosting and/or foraging habitat for Indiana bats. Indiana bats may also forage over wetlands, streams, and adjacent grassland areas near forests. Within the Project Area there are approximately 282 acres (114.1 hectares) or potential foraging habitat. Additional potential roosting and foraging habitat also exists upstream and downstream of the Project Area. While foraging habitat was present within the Project Area large trees with characteristics of providing a maternity roost for Indiana bats were not observed during site visits in 2011 and 2012.

4.4.2.1.3 *Rayed Bean*

The Project Area lies within the range of the federally endangered rayed bean. The rayed bean is generally known from smaller, headwater creeks, but records exist in larger rivers. They are usually found in or near shoal or riffle areas, and in the shallow, wave-washed areas of lakes. Substrates typically include gravel and sand, and they are often associated with, and buried under the roots of vegetation, including water willow (*Justicia americana*) and water milfoil (*Myriophyllum* sp.).

There are no current records of rayed bean known from the Project Area (ODNR 2011a and USFWS 2012a). A freshwater mussel survey was completed for the construction of the raw water intake during summer 2010 and did not locate any rayed bean within the footprint of the intake structure (EnviroScience 2010a). Similarly, a mussel survey conducted during September 2011 within downstream areas of the Ballville Dam found no rayed bean or other federally listed mussel species within the Project Area (Stantec 2011b). Both surveys, EnviroScience (2010a) and Stantec (2011a), indicate a lack of suitable substrate habitat for the rayed bean. Stantec (2011a) documented substrates that were coarse-grained, silt/clay, and/or exposed bedrock; all of which are unsuitable for the rayed bean. During summer 2013, the Service identified the rayed bean as not occurring within the Sandusky River.

4.4.2.1.4 Kirtland's Warbler

The Project Area lies within the migratory range of the federally endangered Kirtland's warbler. This species migrates through Ohio in the spring and fall, traveling between breeding locations in Michigan, Wisconsin, and Ontario and wintering locations in the Bahamas. While migration occurs in a broad front across the entire state, approximately half of all observations in Ohio have occurred within three miles of the shore of Lake Erie. During migration, individual birds usually forage in shrub/scrub or forested habitat and may stay in one area for a few days.

There are no current records for Kirtland's warbler within the Project Area; however records exist in neighboring Seneca, Ottawa, and Erie Counties. Suitable migration stopover habitat exists adjacent to the river, and includes forest and shrub/scrub habitat.

4.4.2.1.5 Northern long-eared bat

The Service has proposed to list the northern long-eared bat (*Myotis septentrionalis*) as endangered under the ESA, due to population declines associated with white-nose syndrome (WNS), a novel fungal disease that is substantially impacting bat populations in the northeastern

U.S. and rapidly spreading across the Midwest. A decision on whether or not to finalize the proposed listing is to be made by April 2015.

No northern long-eared bats were detected during mist net surveys in 2010 associated with the off channel reservoir project, at an area approximately 0.9 miles (1.4 kilometers) upstream from the Ballville Dam (EnviroScience 2010b). However, the Ballville Dam project area has not been surveyed. The northern long-eared bat utilizes forested habitat and may occur within forested portions of the project area. 107.9 acres (43.7 hectares) of potential habitat for this species exists within the Project Area. Additional potential foraging habitat also includes the riparian zones along the Sandusky River upstream and downstream of the Project Area.

4.4.2.1.6 *Bald Eagle*

The project lies within the range of the bald eagle, a federal species of concern. The bald eagle generally nests in large trees along rivers, lakes, and reservoirs where they catch fish and scavenge for dead animals to feed themselves and their young. Both the Service (2012) and ODNR (2011b) have identified two records of bald eagle nests in and near the Project Area. The Fremont Nest is located approximately one mile (1.6 kilometers) downstream and the Portage Livery Nest is located approximately one mile (1.6 kilometers) upstream of the Ballville Dam. These nests were both active in 2012. Additional bald eagle nests exist both upstream and downstream of the Project Area, along the Sandusky River. Bald eagles likely forage along portions of the Sandusky River that include the Project Area.

4.4.2.2 State Threatened, Endangered, and Species of Concern

A total of 13 state listed species (including six federally listed species) were identified by the ODNR as potentially occurring in or near the Project Area (ODNR 2011a). Six additional species were identified through records searches found online at www.dnr.state.oh.us. Two additional mussels were identified in the Ohio State University Bivalve Database. These additional eight species warrant inclusion due to either historic or current records not identified by resource agencies.

Twenty one state listed species have known records of occurrence within the lower Sandusky River watershed including within, or near the Project Area. Six of these species are federally listed (i.e. eastern prairie fringed orchid, Indiana bat, rayed bean, Kirtland's warbler, piping plover, and eastern massasauga rattlesnake). Five species (bobcat, American bittern, king rail, Black Sandshell, and Wavy-rayed Pocketbook) do not have records from within the Project Area or are not expected to occur (Table 4-7). A total of 10 state listed species have known records from the lower Sandusky River watershed and habitat that includes or potentially could include the Project Area. Those species are northern harrier, trumpeter swan, Western Banded Killifish, Greater Redhorse, River Redhorse, threehorn wartyback, deertoe, purple wartyback, kidney shell, and round pigtoe. Table 4-10 provides a summary of these species general habitat conditions and records or potential to occur within the Project area.

4.5 LAND USE

4.5.1 Scope of Analysis

The analysis of land use in this FEIS examines the current land uses in the Project Area. These resources could be affected by the Project depending on the alternative selected. This land use analysis is based on publicly available data from the National Land Cover Dataset (USGS 2006) and information from Ballville Dam Removal Feasibility Study (Stantec 2011b).

4.5.2 Existing Conditions

4.5.2.1 Land Use

Prior to settlement of the region, the Sandusky River watershed consisted primarily of beech forests and elm-ash swamp forests (Braun 1950). Currently, agricultural practices dominate the watershed and the majority of the old forests and swamps has been cleared and drained (OEPA 2011a).

The Project Area is approximately 526 acres (212.9 hectares) in size and consists of nine different land uses (Figure 4-6, Figure 4-7). Seventy-seven percent of the Project Area can be categorized into three different land uses: open water (i.e. Sandusky River), developed-open space (i.e. future park spaces; residential spaces; River Cliff Golf Course), and deciduous forest located throughout the Project Area (Figure 4-6, Figure 4-7; Table 4-11).

Table 4-11. Land Uses Within the Project Area

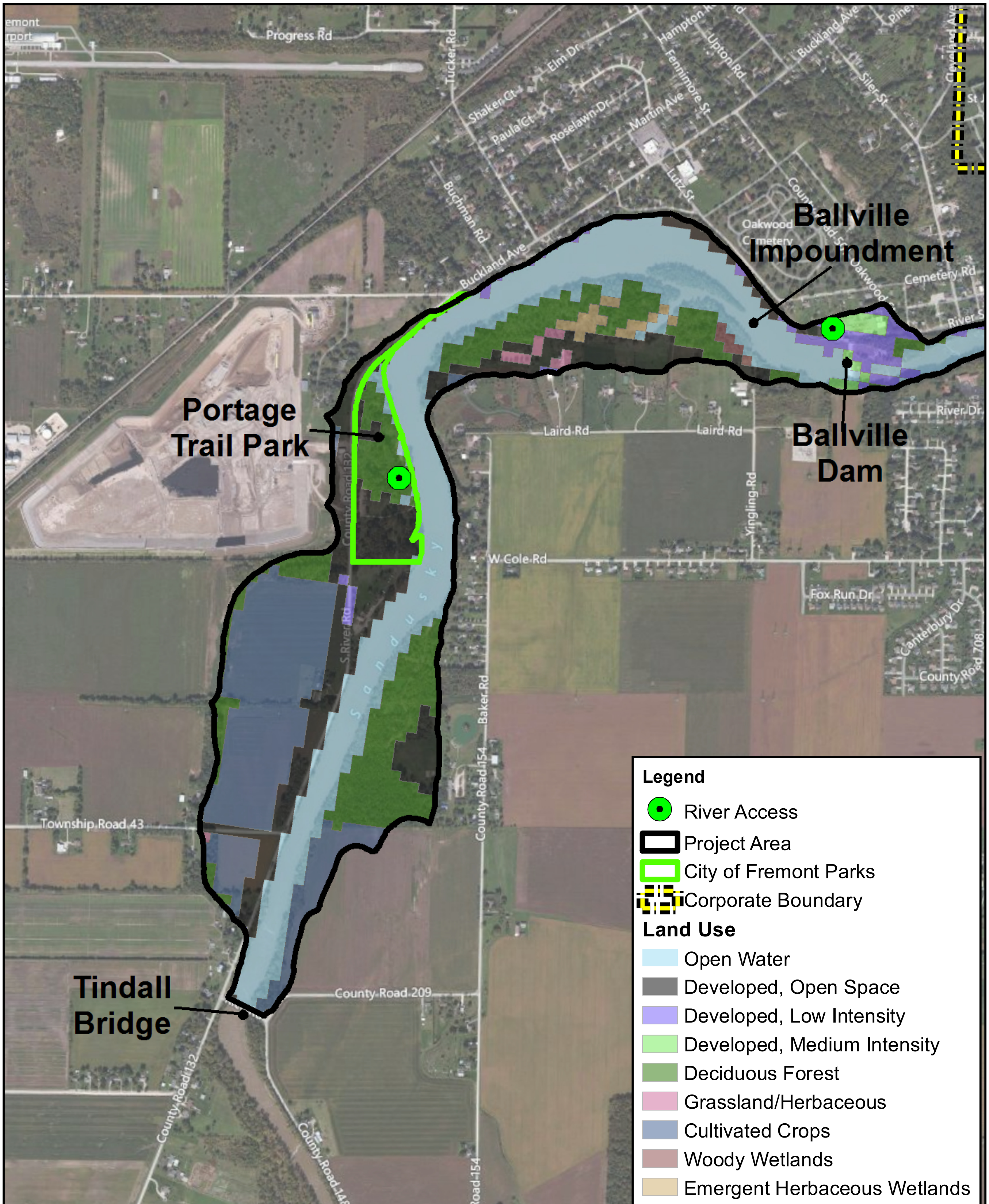
Land Use Type	Percentage	Acres
Open Water	28	147.0
Developed, Open Space	28	148.7
Developed, Low Intensity	5	26.6
Developed, Medium Intensity	<1	1.6
Deciduous Forest	21	107.9
Grassland/Herbaceous	1	5.6
Cultivated Crops	13	67.1
Woody Wetlands	<1	1.3
Emergent Herbaceous Wetlands	4	20.4
Total	**100**	**526.2**

Source: USGS 2006

The open water category is exclusively comprised of the Sandusky River. Developed, Open Space is an aggregate of primarily four areas. The largest area is River Cliff Golf Course downstream of the Ballville Dam. There are several residential areas upstream of the Ballville Dam on the south side of the river off of Laird Road between private residences and the Sandusky River that are categorized as “developed, open space” as well. A third area, upstream of the Ballville Dam and north of the river, is the future site of a Ballville Township park. This future park is adjacent to the new City of Fremont raw water reservoir. Lastly, further upstream of the Dam is a future Ballville Township park. This area is downstream of the Tindall

Bridge and within the Project Area. See Figure 4-6 and Figure 4-7 for locations of "developed, open spaces" and other defined land uses.

Deciduous forests are located along the banks of the Sandusky River with the largest woodlots upstream of the Ballville Dam. There are riparian forests downstream of the dam opposite the River Cliff Golf Course in addition. See Figure 4-6 and Figure 4-7 for location of land uses in the Project Area.



Basemap: BING

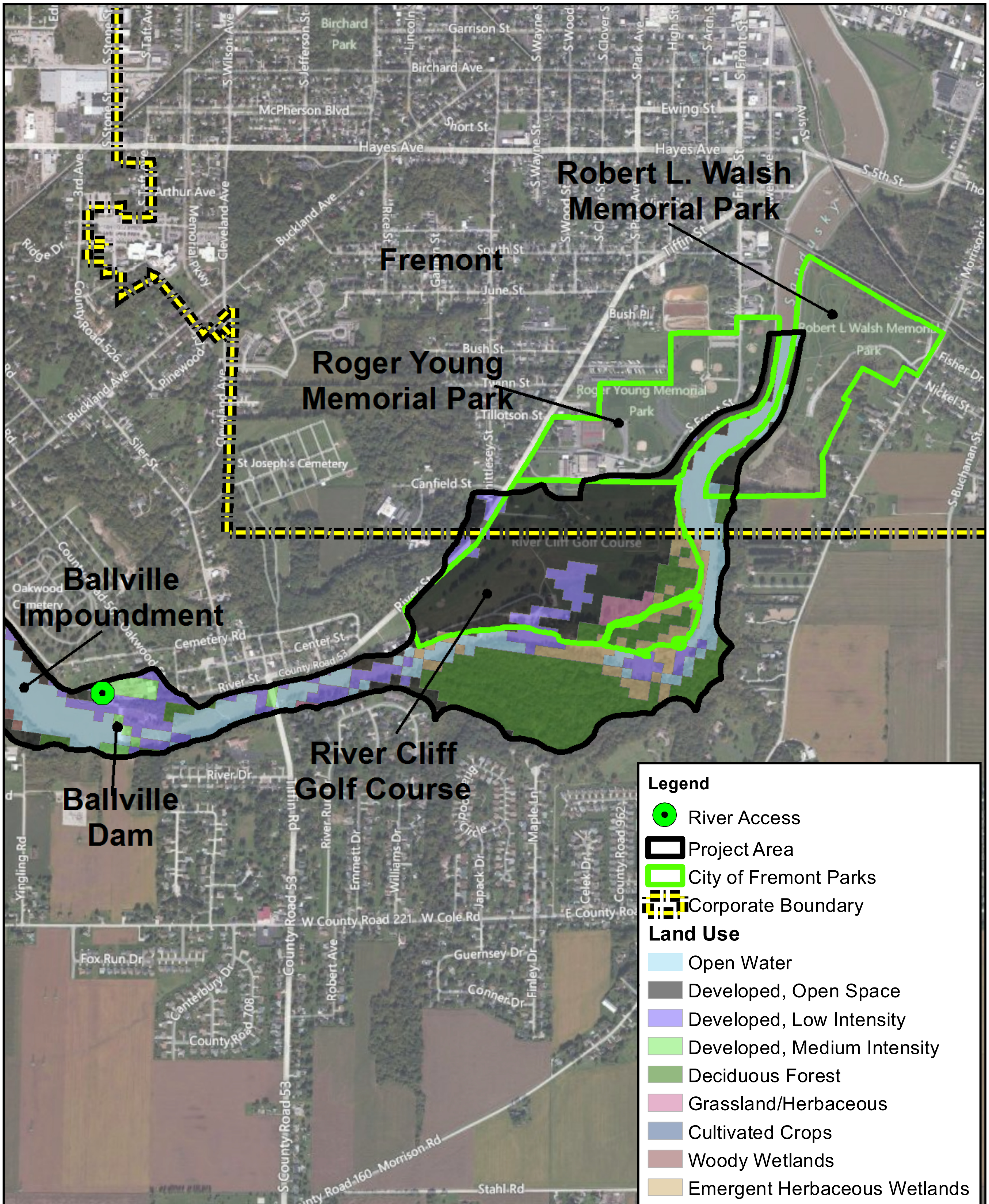
Landuse in the Project Area Upstream of Ballville Dam

N W E S

Ballville Dam Project

0 700 1,400 Feet

Figure 4-6



Basemap: BING

Landuse in the Project Area Downstream of Ballville Dam

Ballville Dam Project

0 700 1,400 Feet

Figure 4-7

4.6 RECREATION

4.6.1 Scope of Analysis

The recreation analysis for the FEIS provides a discussion of current and future recreation opportunities. These resources could be affected by the Project and extend beyond the geographical boundaries of the Project Area. Therefore, they are described at a larger scale: from the Bacon Low Head Dam in Tiffin, Ohio into Sandusky Bay and Lake Erie.

The recreation analysis in this FEIS is based on publicly available state, regional, county, and municipal-level planning documents, as well as information from the Ballville Dam Removal Feasibility Study (Stantec 2011b).

4.6.2 Existing Conditions

4.6.2.1 Fishing

An estimated 700,000 trips to Lake Erie were made by anglers from all over the United States and Canada in 2012 (ODNR 2013d). Hours of angling effort increased by 27 percent in 2012 (3.7 million angler hours) as compared to 2011 (2.67 million angler hours). Recreational fishing on Lake Erie and its tributaries continues to provide significant economic revenues for the State of Ohio. In 2012, angler interviews indicated that most private boat fishing effort was directed towards Walleye (52%) and Yellow Perch (43%), while Smallmouth Bass, Largemouth Bass, and White Bass angler fisheries were minor components of the overall fishing effort (ODNR 2013d).

The Ohio Division of Wildlife (ODNR 2013d) estimated that during 2012, a total of 4.8 million pounds of fish were harvested by the commercial fishery, an eight percent increase, as compared to 2011. Ohio's recreational fishery accounts for nearly $500 million in retail sales annually (Southwick Associates 2013), with total economic impacts of Lake Erie recreational fisheries nearly $800 million. While Lake Erie recreational fisheries provide significant economic revenue to the State of Ohio, revenue generated from this fishery is significantly lower than historically, when targeted Walleye fishing effort was nearly 10 million angler hours (ODNR 2013d).

The majority of Lake Erie Walleye originate from three spawning areas in western Lake Erie; mid-lake reef complex and islands, Maumee River, and the Sandusky River and Bay (Weimer 2010; ODNR 2012d). Fishing in the Sandusky River is a common pastime of local residents, as well as others from around the state of Ohio, and is a major economic driver for the angling tourism to Lake Erie and the lower Sandusky River (ODNR 2012d). Sandusky River anglers spent nearly 33,000 hours angling for Walleye and White Bass during the annual spawning migrations in 2012 (ODNR 2013d).

Ohio Division of Wildlife creel surveys conducted in 2011 show that anglers traveled to Lake Erie from 39 states (including Ohio) and one foreign country (ODNR 2012d). In 2011, Sandusky

River targeted Walleye angling totaled 22,796 hours of effort. In contrast, Walleye angling effort in the nearby Maumee River accounted for 133,015 hours (ODNR 2012d). Bigrigg (2008) analyzed otolith microchemistry signatures and concluded that the Sandusky River Walleye stock comprised only one percent of the recreational catch in Lake Erie while the Maumee River accounted for 42 percent of the recreational catch. Other regionally important sport fish that utilize the Sandusky River for reproduction or rearing include White Bass, Yellow Perch, and Smallmouth Bass.

The Sandusky River Walleye migrate from Lake Erie into the Sandusky River beginning in March. The peak of the spawning run typically occurs during the first two weeks of April (Weimer 2010). In the Great Lakes region, Walleye are known to migrate up to 60 miles inland to spawning grounds (Mrozinski et al. 1991, Kerr et al. 1997).

Other species important to the Lake Erie fishery and its major tributaries such as the Sandusky River include Yellow Perch, Smallmouth Bass, and White Bass. These sport fish also undertake migrations from Lake Erie to spawning habitats in the Sandusky River. The White Bass migration, in particular, is an important seasonal fishery. White Bass migration distances exceeding 150 miles have been documented in other systems (Hamilton and Nelson 1984).

The area below the Ballville Dam serves as a popular fishing area. Further, fishing occurs on both sides of the impoundment area at various points, including from the campground and other properties. For example, according to local anglers, “Fishing Rock,” located near the ruins of the old stone mill on the impoundment, provides excellent catfish and bullhead fishing.

Rowboats, motorboats, and canoes also are frequent users of the impoundment area for fishing. The impoundment area gives fishermen the “lake effect” of fishing while still being on a river. Night fishing is also popular in the late spring and summer in the impoundment area.

Anglers above the Ballville Dam generally are seeking various Bass species and Catfish. Currently there are six river access points for anglers with canoes or other smaller boats to access the Sandusky River upstream of the Ballville Dam to the City of Tiffin.

4.6.2.2 Boating

Motorized boat traffic is common between Fremont and Sandusky Bay. The upstream limit of travel is in the City of Fremont between the State Street Bridge and the Norfolk and Western Rail Bridge that crosses Brady’s Island, depending on water levels. A boat ramp is located on the side channel east of Brady’s Island. Multiple ramps and marinas are located between Fremont and the mouth of the Sandusky River, including the Fremont Yacht Club which is located just north of the U.S.6 Bridge. The river enters Muddy Creek Bay before entering Sandusky Bay. Muddy Creek Bay is generally shallow and is difficult to navigate during low water periods.

Motorized boat traffic is severely restricted upstream of the Ballville impoundment due to the frequency of steep, shallow, bedrock riffles and is primarily limited to small boats with trolling motors. However motorized boat use does occur within the Ballville impoundment.

Non-motorized boating including canoeing and kayaking is a frequent, popular activity on all sections of the river and includes both outdoor recreation businesses and individuals. Multiple access points are located along the length of the river. Two boat access points are located within the Project Area (Figure 4-6, Figure 4-7). The Ballville Dam poses a barrier between upstream travel and the bay, as there is no portage. A total of nine river access points exist between the City of Tiffin and Sandusky Bay (unpublished data from ODNR).

4.6.2.3 Parks and Recreation

Within the project area there are four designated parks. The following parks are present: Portage Trail Park, River Cliff Golf Course, Roger Young Memorial Park, and Robert L. Walsh Memorial Park. See Figure 4-6 and Figure 4-7 for location of these four parks.

4.6.2.3.1 *Roger Young Memorial Park*

This park is owned and operated by the City of Fremont and is located approximately 1.5 miles (2.4 kilometers) downstream of the Ballville Dam on the northwestern bank. The park includes baseball/softball fields, tennis courts, basketball courts, playground, shelters, restroom facilities, and multi-purpose fields. This park was dedicated to World War II hero Rodger W. Young in 1943.

4.6.2.3.2 *Robert L. Walsh Memorial Park*

This park is the largest park that the City of Fremont owns and is located approximately 1.8 miles (2.9 kilometers) downstream of the Ballville Dam on the southeastern bank. It contains trails, playgrounds, shelters, restroom facilities, fountain, and memorial garden. This park was dedicated to Robert L. Walsh in 1996.

4.6.2.3.3 *Portage Trail Park*

This is a privately owned park located approximately 1.5 miles (2.4 kilometers) upstream of the Ballville Dam along River Road in Ballville Township, Ohio. This property provides camping opportunities and river access. This park is located upstream of the Ballville Dam and is adjacent to the impoundment.

4.6.2.3.4 *River Cliff Golf Course*

This park is a public golf course located along the bank of the Sandusky River. River Cliff is a 9-hole course located approximately 1 mile (1.6 kilometers) downstream of the Ballville Dam along the northern bank.

4.6.2.3.5 *Other Recreational Activities*

The City of Fremont provided information to the Service regarding local use of the dam and surrounding areas for a variety of recreational activities. The impoundment area behind the dam has a history of trapping, specifically for snapping turtles and muskrat. During the fall, the impoundment area is occasionally used for waterfowl hunting. During hard winters, the ice in the impoundment area provides ice skating, sledding, and snowshoeing opportunities.

Bird watching is another activity that occurs in this area. During migration the impoundment area provides habitat for waterfowl, and forest and wetland areas provide songbird habitat year-round.

The area immediately below the dam is popular for picnicking, hiking, and climbing amongst the rocks. Citizens enjoy the experience of the “waterfall” created by the dam. Camping is also a popular activity around the impoundment area.

4.7 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

4.7.1 Scope of Analysis

This section of the FEIS describes the population, housing, employment, income, tax structure, and property values within the Project Area and within nearby townships and cities. In addition to socioeconomic resources, this evaluation also provides a discussion of environmental justice issues including information on minority and low-income populations. Demographic, economic, and housing data were examined within four geographic areas (hereafter referred to as the “relevant geographies”) to provide the context used to benchmark characteristics and trends in central Ohio: 1) Ballville Township; 2) City of Fremont; 3) Sandusky County; and 4) the State of Ohio. These relevant geographies are used in the context of socioeconomics due to Project interaction with and potential impact on broader regional systems that spread beyond the boundaries of the Project Area.

The socioeconomic and environmental justice analysis in this FEIS draws upon publicly available information from the counties and townships listed above from the United States Census Bureau (decennial censuses and American Community Surveys).

4.7.2 Existing Conditions

4.7.2.1 Demographics

Population declines have been observed in Sandusky County, Ballville Township, and the City of Fremont between 2000 and 2010 (Table 4-12). During that 10 year period, population in Ballville Township and the City of Fremont declined by approximately 6.4 percent and 3.6 percent, respectively (U.S. Census Bureau 2010). During the same 10 year period the State of Ohio experienced a population increase of 1.6 percent. Overall, Sandusky County is projected to decline by an estimated five percent between 2010 and 2020 (U.S. Census Bureau 2010).

Table 4-12. Community Populations Near the Project Vicinity

Governmental Unit	Population		Change	
	2000	2010	2000-2010	Percent
Ballville Township	6,395	5,985	-410	-6.4%
City of Fremont	17,375	16,734	-641	-3.6%
Sandusky County	61,792	60,944	-848	-1.4%
State of Ohio	11,353,140	11,536,504	183,364	1.6%

Source: U.S. Census Bureau, 2010

4.7.2.2 Age Cohorts

Evaluating population age cohorts helps to understand the types of development that a community might demand or prefer in the future. Age cohort data is also used in evaluating whether an action could have disproportionate adverse health or safety risk effects on individual age classes.

Data indicate that Ballville Township has a lower proportion of preschool, school age, college age, and working adults than the City of Fremont, Sandusky County, or the State of Ohio (Table 4-13). However, Ballville Township has a larger proportion of population greater than 55 years of age (Table 4-13). The City, County, and State all fall within two or three percentage points on generally all subject ages.

Table 4-13. Age Cohort Profile, 2010

	Ballville Township		City of Fremont		Sandusky County		State of Ohio	
Cohort (age in years)	**Total**	**%**	**Total**	**%**	**Total**	**%**	**Total**	**%**
Total population	5,985	100%	16,734	100%	60,944	100%	11,536,504	100%
Preschool (< 5)	246	4.1%	1,336	8.0%	3,826	6.3%	720,856	6.2%
School Age (5-19)	1,024	17.1%	3,610	21.6%	12,494	20.5%	2,346,270	20.3%
College Age (20-24)	234	4.0%	1,031	6.2%	3,204	5.3%	763,116	6.6%
Working Adults (25-54)	2,189	36.5%	6,604	39.5%	24,092	39.5%	4,631,981	40.2%
Empty Nesters (55-64)	1,063	17.8%	1,831	10.9%	8,013	13.2%	1,452,266	12.6%
Seniors (>65)	1,229	20.5%	2,322	13.9%	9,315	15.2%	1,622,015	14.1%
Median Age (years)	49.2		35.3		40.4		38.8	

Source: U.S. Census Bureau, 2010

4.7.2.3 Housing Characteristics

In general, Ballville Township housing characteristic data indicate that there are a high percentage of occupied homes with approximately 81 percent occupied by the owner (Table 4-14). Conversely, approximately five percent of housing units are vacant. Figures for the City of Fremont, Sandusky County, and the State of Ohio have relatively similar characteristics with respect to percentages of housing units occupied, occupied by owners, and vacant. However, owner occupied housing within the City of Fremont was approximately 55 percent, while overall, Sandusky County data indicate 69 percent of owners occupy their houses.

Table 4-14. Housing Characteristics, 2006-2010

Subject	Ballville Township	City of Fremont	Sandusky County	State of Ohio
Total Housing Units	2,707	7,601	26,385	5,107,273
Occupied	2,566	6,791	24,109	4,552,270
Homeowner	2,192	4,200	18,243	3,149,052
Renter	374	2,591	5,866	1,403,218
Vacant	141	810	2,276	555,003

Source: U.S. Census Bureau 2010; 2006-2010 American Community Survey

Housing values averaged highest in Ballville Township at a median value of owner-occupied units of $155,800 (Table 4-15). Housing values in Ballville Township were highest when compared to the City of Fremont, Sandusky County, and the State of Ohio. Conversely, median monthly rent was lower than the average for Sandusky County and the State of Ohio and only slightly higher than rental averages for the City of Fremont (Table 4-15).

Table 4-15. Housing Values and Median Monthly Rents, 2006-2010

Subject	Ballville Township	City of Fremont	Sandusky County	State of Ohio
Median Housing Value (Owner-occupied Units)	$155,800	$89,800	$116,300	$136,400
Median Monthly Rent (Renter-Occupied Units)	$548	$534	$568	$678

Source: U.S. Census Bureau 2010; 2006-2010 American Community Survey

4.7.2.4 Income Characteristics

The median household income for Ballville Township is approximately $20,600 greater than that of the City of Fremont; $11,900 greater than Sandusky County; and $12,600 greater than the State of Ohio (Table 4-16). According to data from the U.S. Census Bureau (2010) and the American Community Survey, the City of Fremont has a slightly higher rate of unemployment (9.5%) than Ballville Township (4.9%), Sandusky County (6.6%), and the State of Ohio (8.6%).

Table 4-16. Income Characteristics, 2006-2010

Subject	Ballville Township	City of Fremont	Sandusky County	State of Ohio
Median Household Income	$60,000	$39,398	$48,056	$47,358
Population In Labor force	3,292	8,379	31,774	5,889,779
Employed	3,130	7,582	29,616	5,877,987
Unemployed	162	797	2,106	508,130
Armed Forces	0	0	52	11,792

Source: U.S. Census Bureau 2010; 2006-2010 American Community Survey

4.7.2.5 Employment Characteristics

The region's leading industries are manufacturing, educational and healthcare services, and social assistance. Ballville Township, City of Fremont, and Sandusky County are relatively homogeneous in regards to workforce characteristics (Table 4-17).

Table 4-17. Employment, By Industry

Industry	Ballville Township		City of Fremont		Sandusky County	
	Estimate	%	Estimate	%	Estimate	%
Civilian employed population 16 years and older	3,130	100%	7,582	100%	29,616	100%
Agriculture, forestry, fishing, hunting, and mining	107	3.4%	182	2.4%	740	2.5%
Construction	142	4.5%	525	6.9%	2,056	6.9%
Manufacturing	879	28.1%	2,187	28.8%	8,004	27.0%
Wholesale trade	67	2.1%	91	1.2%	546	1.8%
Retail trade	276	8.8%	748	9.9%	3,095	10.5%
Transportation and warehousing, and utilities	120	3.8%	334	4.4%	1,585	5.4%
Information	0	0	101	1.3%	229	0.8%
Finance and insurance, and real estate and rentals	85	2.7%	295	3.9%	938	3.2%
Professional, scientific, and management, and administrative and waste management services	129	4.1%	438	5.8%	1,409	4.8%
Educational services, health care, social assistance	867	27.8%	1,413	18.6%	6,388	21.5%
Arts, entertainment, and recreation, and accommodation and food service	137	4.4%	742	9.8%	2,422	8.2%
Public administration	128	4.1%	256	3.4%	830	2.8%
Other services	193	6.2%	270	3.6%	1,374	68.0%

Source: U.S. Census Bureau 2010; 2006-2010 American Community Survey

4.7.2.6 Socioeconomic Data Relevant to Environmental Justice Concerns

In response to Executive Order 12898, federal agencies are required to address potential environmental justice impacts to minority and low income populations. The information in this section provides the necessary background for the analysis of whether the project would have a disproportionately high and adverse effect on minority and low income populations.

4.7.2.6.1 *Minority Populations*

The percentage of individuals identified as Caucasian was higher in all geographies considered for analysis (Table 4-18). Minority populations within Ballville Township and Sandusky County are all less than 10 percent of the total population (3.1% and 8.7%, respectively). The percentage of the minority populations in the City of Fremont is higher than the state average at 19.2 percent (State of Ohio-17.3%).

Table 4-18. Minority Population, 2010

Subject	Ballville Township		City of Fremont		Sandusky County		State of Ohio	
Race	**Total**	**%**	**Total**	**%**	**Total**	**%**	**Total**	**%**
Total Population	5,985	100.0 %	16,734	100.0%	60,944	100.0%	11,536,504	100.0%
One Race	5,912	98.8%	15,880	94.9%	59,349	97.4%	11,298,739	97.9%
Caucasian	5,681	94.9%	13,510	80.7%	55,579	91.2%	9,539,437	82.7%
African American	92	1.5%	1,384	8.3%	1,712	2.8%	1,407,681	12.2%
Native American/ Alaska Native	4	0.1%	40	0.2%	132	0.2%	25,292	0.2%
Asian	24	0.4%	54	0.3%	189	0.3%	192,233	1.7%
Native Hawaiian/ Pacific Islander	0	0.0%	3	0.0%	7	0.0%	4,066	0.0%
Other	111	1.9%	889	5.3%	1,730	2.8%	130,030	1.1%
Multiple Races	73	1.2%	854	5.1%	1,595	2.6%	237,765	2.1%
Total Minority	304	3.1%	3,224	19.2%	5,365	8.7%	1,997,067	17.3%
Hispanic/Latino	286	4.8%	2,700	16.1%	5,435	8.9%	354,674	3.1%

Source: U.S. Census Bureau 2010

4.7.2.6.2 *Low Income Populations*

Median household income can help to depict the financial state of a community and poverty levels are used to determine whether or not there is economic hardship or need. In the American Community Survey, poverty is determined through a sample of household or family income, against a series of federal thresholds that take into account age, family size, and the presence of children. Ballville Township had the lowest poverty percentage at 1.8 percent while the City of Fremont was the highest among geographies analyzed (Table 4-19). Sandusky County had lower poverty rates than the state as a whole (7.2% to 10.3%).

Table 4-19. Percentage of Families Below the Poverty Level, 2006-2010

Subject	Ballville Township	City of Fremont	Sandusky County	State of Ohio
Median Household Income	$60,000	$39,398	$48,056	$47,358
Percent of population below poverty	1.8%	14.2%	7.2%	10.3%

Source: U.S. Census Bureau 2010; 2006-2010 American Community Survey

4.8 CULTURAL AND HISTORIC RESOURCES

4.8.1 Scope of Analysis

Sites, buildings, structures, and objects that may be affected by a proposed action are identified and evaluated for either architectural or archeological significance. These resources are often referred to as "cultural resources" or sometimes "properties." Some of these resources can be historic while others are not. Historic refers to properties that have a historical, architectural, engineering, archaeological, or cultural significance. The NRHP is the repository of documentation for properties that have significance. The following guidelines were developed by the National Park Service for the election of properties to be included in the NRHP consistent with the Secretary of Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (NPS 1983).

A building, site, structure, or object is significant if it possesses integrity of location, design, setting, materials, workmanship, feeling, and association, and fulfills at least one of the following National Register Criteria of Evaluation:

- Criterion A – association with events that have made a significant contribution to the broad patterns of our history;
- Criterion B – association with the lives of persons significant in our past;
- Criterion C – embodies the distinctive characteristic of type, period, or method of construction, or that represents the work of a master, or possesses high artistic values, or represents a significant and distinguished entity whose components may lack individual distinction; and
- Criterion D – has yielded or may be likely to yield information important in prehistory or history (36 CFR Part 60.4).

Some properties are not ordinarily considered eligible for the NRHP such as "cemeteries, birthplaces, or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years." These types of properties, however, may be eligible under special circumstances called criteria considerations (36 CFR Part 60.4).

The National Historic Preservation Act of 1966 requires the consideration of the potential impacts of federally funded projects on cultural resources that are listed in the NRHP or on properties found eligible for the NRHP, even if not actually listed.

Pursuant to federal regulations for the Protection of Historic Properties, the project's Area of Potential Effect (APE) is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist." The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking" (36 CFR Part 800.16[d]). The APE for the Ballville Dam project was determined by the Service Region 3 Regional Historic Preservation Officer and coordinated with the State of Ohio Historic Preservation Office (SHPO) in February 2012.

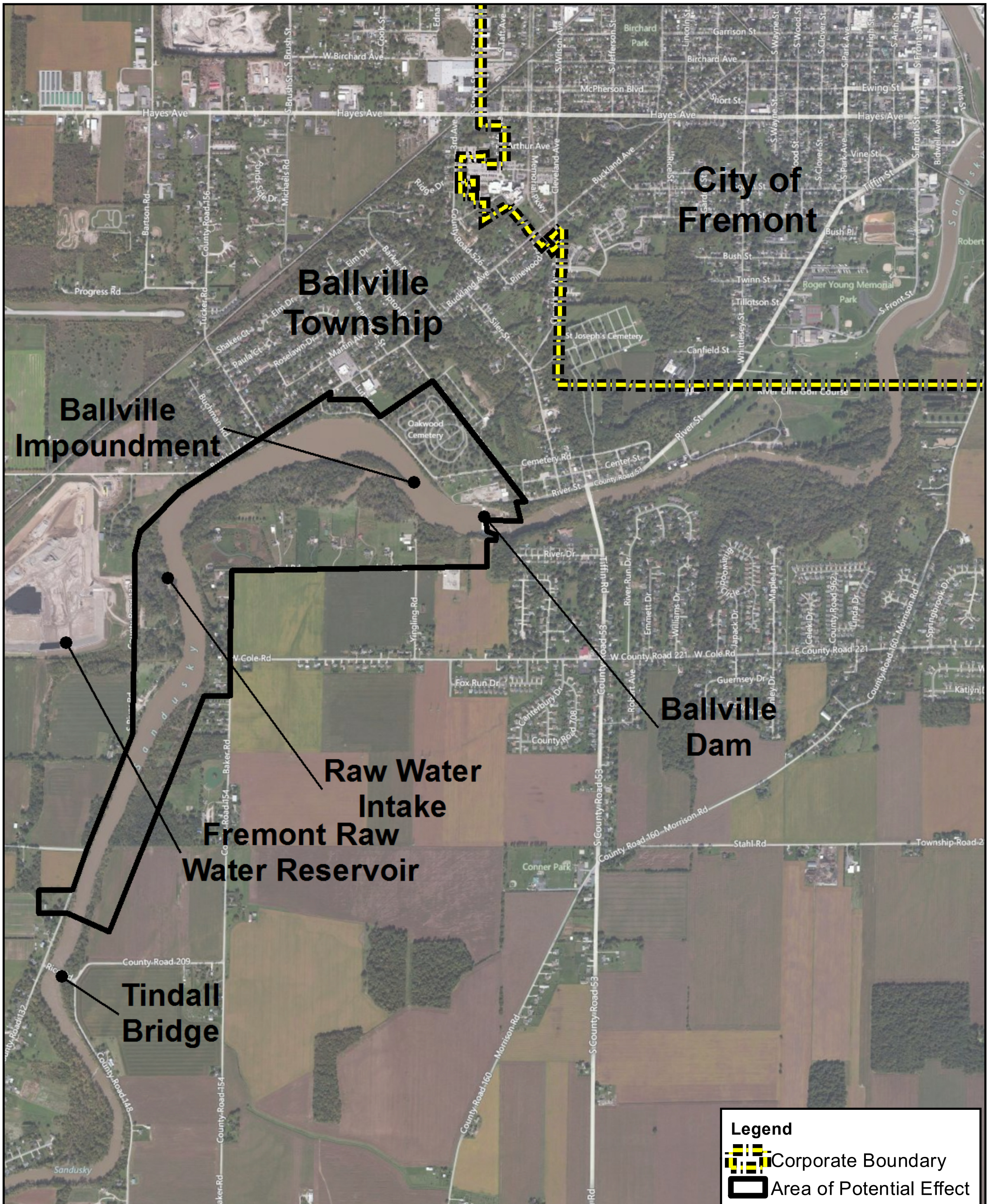
The APE consists of the Ballville Dam, dam impoundment; parcels abutting the dam pool, with some exceptions where above ground resources are at a distance from the river; and, where a public road runs along the edge of the river, parcels facing onto the dam pool (Figure 4-8). Although not within the APE, the former hydroelectric plant downstream of the dam is considered sufficiently historically and functionally related to the dam to be included. Results of surveys conducted within the APE are described below.

4.8.2 Existing Conditions

4.8.2.1 Phase I Literature Review and Field Investigation

During summer 2011, a Phase I literature review and field investigation was completed to identify and document cultural resources with the APE and to determine if identified resources might be eligible for inclusion in the NRHP (ASC 2011). The literature survey focused on understanding the environmental setting, prehistory and history within the environment, and previous research in the region and APE. The literature survey examined the Ohio Historic Preservation Office Geographic Information System (GIS), which includes National Historic Landmarks (NHL) and NRHP listed and formally determined eligible (DOE) cultural resources. The Ohio Department of Transportation (ODOT) online Historic Bridge List and Buckeye Assets were also reviewed (ASC 2011). Additionally, historical maps and atlases pertinent to the project at the Ohio Historical Society's Library were examined. Additional resources consulted included the following:

- NRHP preliminary and consensus determination of eligibility lists;
- NHL list;
- Inactive NRHP nomination forms;
- NRHP questionnaires;
- NRHP drafts/post-Ohio Historic Site Preservation advisory Board draft nomination forms;



Basemap: BING

The Cultural Resource Area of Potential Effect (APE)

Ballville Dam Project

0 1,000 2,000 Feet

Figure 4-8

- USGS 7.5' and 15' topographic maps associated with the Ohio Archaeological Inventory (OAO);
- OAI forms;
- Ohio Historic Inventory (OHI) forms;
- Contract archaeology report;
- *Archeological Atlas of Ohio* (Mills 1914); and
- *Ohio Cemeteries: 1803-2003* (Troutman 2003).

The literature review identified no properties listed in, or previously determined eligible for the listing in the NRHP within the APE. Additionally, no previously inventoried history/architecture resources were identified within the APE. Previously inventoried archaeological sites are located adjacent to, but not within, the archeological survey areas (ASC 2011).

4.8.2.2 History/Architecture Survey

Information obtained during the literature survey and data from the Sandusky County GIS website were consulted to aid in identification of properties within the APE that were more than 50 years of age. Subsequently, a field visit was conducted at each of the properties during the history/architecture survey. The information gathered was used to help make determinations regarding resource integrity, yielding additional data by which the eligibility for the listing on the NRHP could be judged. The NRHP Criteria for Evaluations listed in Section 1.8.1 were used to evaluate eligibly of resource.

Any property that meets one or more of the above criteria must also contain a high degree of historic integrity as well as being significant. Historic integrity is defined as the ability of a property to convey its architectural significance. There are seven aspects that determine a property‘s historic integrity: location, design, setting, materials, workmanship, feeling, and association. Some aspects may be more important than others depending on the resource, and a property does not need to convey all seven aspects in order to be eligible for the NRHP, although it should convey most.

A total of 33 properties were identified as 50 years of age or older and located within the APE. In addition to the Ballville Dam and its associated hydroelectric power plant, these resources mostly consisted of residences ranging in age from the late nineteenth century through the mid-twentieth century. After review of all 33 resources, the following structures were determined to be eligible for the NRHP (ASC 2011):

- The Ballville Dam and former hydroelectric plant. While the former plant is not within the APE, together the two are eligible for listing in the NRHP as a historic district under Criteria A and C for the association with early electricity production and the development of a regional power grid in north-central Ohio.

- A farmhouse. The farmhouse located along South River Road was determined as eligible for the NRHP under Criterion C as an excellent example of Queen Anne-style design.

4.8.2.3 Archaeological Survey

Information obtained during the literature survey was also used to help aid field efforts for the archaeological survey. The APE was visually inspected to identify readily visible archaeological resources such as mounds, earthworks, and building or structure remnants. This inspection also documented areas that have been previously disturbed. In addition to visual inspection, three other methods were used during the Phase I archaeological survey including surface collection, shovel probe excavation, and shovel test pit excavation.

The Ballville Dam removal project would directly affect areas situated along the Sandusky River south of Fremont. These areas include sections of the riverbanks about 4,000 feet (1,219.2 meters) upstream of the dam and encompass about 12 acres (4.9 hectares) of bluff edge, river bank, floodplain, and terrace. These areas were subject to archaeological survey in areas that were not previously heavily disturbed (ASC 2011).

The archaeological survey found that nearly all of the area that would be subject to direct effects has been disturbed and does not contain archaeological deposits (ASC 2011). The agricultural area above the south end of the dam is relatively intact and only plow disturbed. Additionally, there is a section of the western project area along the Sandusky River that contained intact alluvial deposits. No archaeological remains were encountered to a depth of 20 inches (50.8 centimeters) of the alluvium. Soils below 20 inches may harbor buried deposits below the depths of 20 inches.

One archaeological site was encountered and could not be dated (33SA598). Three artifacts were recovered from the plow zone. These artifacts included three small flake fragments and cannot be placed in its historic context, therefore the site was not considered significant. This site was not considered eligible for inclusion in the NRHP (ASC 2011).

4.8.2.4 Other Possible Historic Features

4.8.2.4.1 *Tucker Dam and Tucker Mill*

Numerous dams have been located over time both upstream and downstream of Ballville Dam (ASC 2011). During 2011 bathymetric surveys of the Ballville Impoundment, data readings detected an anomaly in the substrate profile near the location of an old crib/timber dam associated with Tucker Mill. Discovery of this feature occurred after completion of the Phase I field survey. The anomaly was located where historic literature shows photographs of the dam, approximately 1,300 feet (396.2 meters) west of Tucker Mill. The dam used water power to work a flour grist-mill. The mill site is not within the archaeology APE. It currently consists of foundation ruins only.

The potential remnants of what is believed to be the Tucker Dam are located approximately eight feet below normal pool of the impoundment. The structure, if present, cannot be surveyed or evaluated against the NRHP criteria for evaluation without an extensive underwater investigation and potentially extensive excavation of any material that is likely concealing the structure.

4.8.2.4.2 *Creager Mill Dam*

Historic literature review indicated that the Creager Mill Dam may have existed downstream of Ballville Dam. There are two possible locations for this dam but no evidence to indicate its presence. A building foundation may be located near the eastern edge of the archaeology APE, but was not detected during visual examination of the portion of the archaeology APE.

4.9 VISUAL RESOURCES

4.9.1 Scope of Analysis

The following section describes the visual resources within the Project Area. This area encompasses the view of the Ballville Dam and impoundment from public roadways, bridges, and residences. This analysis is based on information gathered from review of aerial photography and site photographs.

4.9.2 Existing Conditions

The Ballville Dam is only observable from a few locations during leaf-on periods of the year. Primarily viewed from the Tiffin Road Bridge (County Road 53), the surrounding riparian margins are vegetated with trees and other densely layered shrubs from the downstream locations. Additionally, the 42 foot (12.8 meters) high south bank as well as the vegetation obscures the view of the dam by elevation constraints. Views from the upstream side of the dam are generally obscured by the seawall and vegetation on the south bank. However, during leaf-off periods of the year the dam may be partially visible through the vegetation when driving along River Street (County Road 501).

The impoundment is visible from Cemetery Road on the north side of the Sandusky River and South River Road to approximately Tindall Bridge. A number of private residences have properties closely abutting the impoundment between Old Plank Road and the intersection of South River Road and Buckland Avenue. There are approximately 66 residential and business-owned properties adjacent to the impoundment.

4.10 TRANSPORTATION

4.10.1 Scope of Analysis

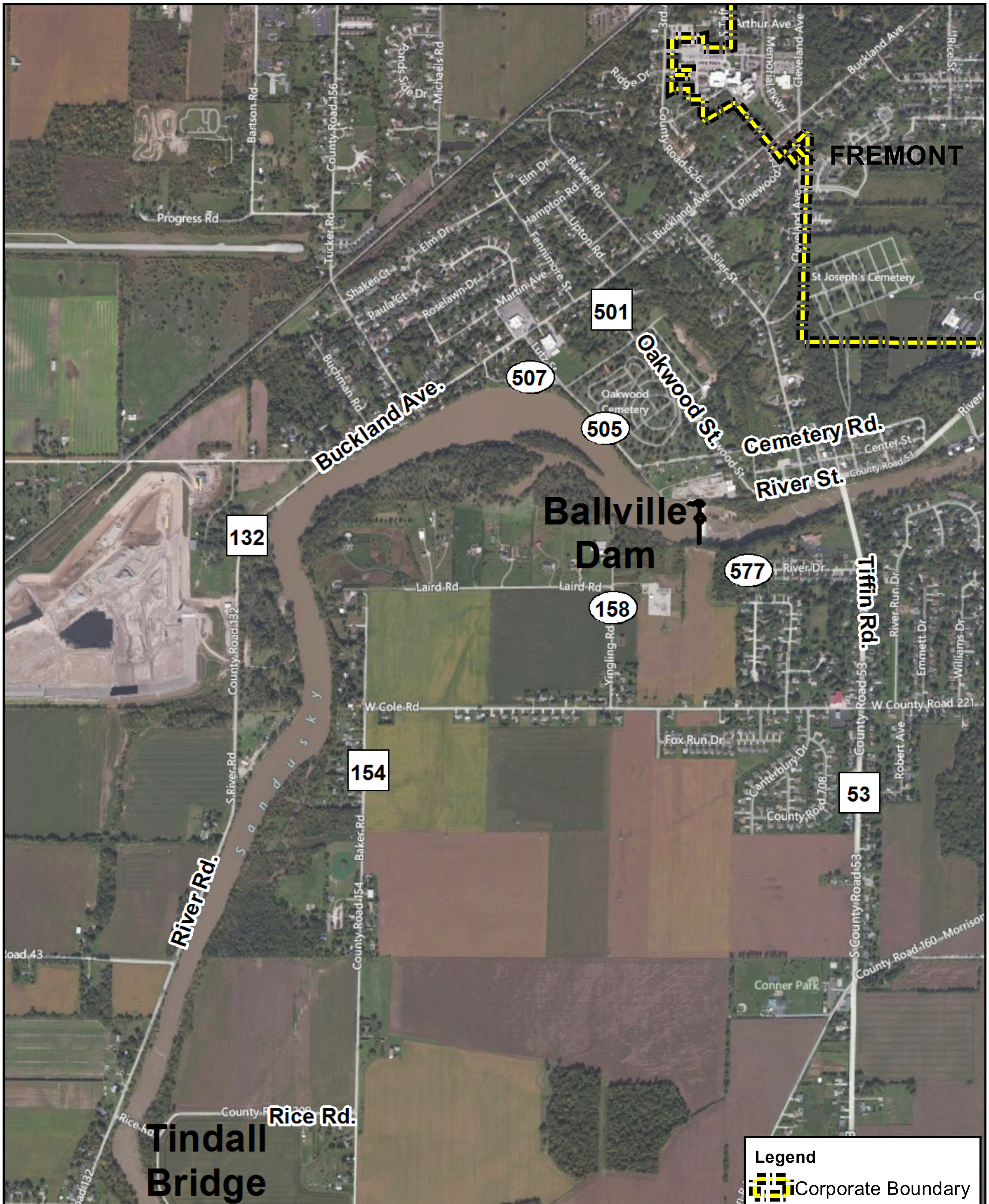
This section of the FEIS describes the conditions of and activity on transportation facilities in Ballville Township and the City of Fremont that are within or near the Project Area. This analysis area was used to account for the potential effects of the Project on transportation infrastructure. The analysis is based on review of maps and satellite imagery publically available from ODOT and Sandusky County.

4.10.2 Existing Conditions

Roads in and near the Project Area are maintained by Ballville Township and the City of Fremont, as delineated by political boundaries. The Township is responsible for normal repair and replacement of road signs, mowing of roadsides, snow and ice removal, water drainage improvements, as well as paving and general road maintenance of approximately four miles of roadway (Kusmer 2011). The Ballville Dam is located within Ballville Township and access is provided from Ballville Township roadways.

There are no designated bikeways, scheduled public transit routes, or state-designated public recreational trails in the Project Area. The local transportation network in the vicinity of the Project location consists of county and local roads that serve the local residents and community. Construction equipment may require, depending on size, transportation permits from the County Engineer's office and the Ohio Department of Transportation. Similarly, any debris that would be physically removed from the site would potentially require haul permits. It is currently not decided how much debris, if any, would require removal via hauling offsite. It is reasonable to assume that nearby roadways would be used for transportation. Roads in the immediate vicinity of Ballville Dam that are most likely to be used to access the dam during construction activities are depicted on Figure 4-9 and include:

- River Street
- Oakwood Street (County Highway 501)
- Cemetery Road (Creek 505)
- Township Highway 507
- River Road (County Highway 132)
- Buckland Ave (Creek 132)
- Rice Road
- County Highway 154
- Township Highway 941
- Township Highway 158
- Township Highway 577
- Tindall Bridge
- Tiffin Road Bridge (County Highway 53).



Basemap: BING

Local Streets and Roadways in the Vicinity of the Ballville Dam

N
W E
S

Ballville Dam Project

0 750 1,500 Feet

Figure 4-9

4.11 AIR QUALITY

4.11.1 Scope of Analysis

No specific air quality monitoring site is located in Sandusky County, Ohio. In order to assess air quality, this section describes the current ambient air quality concentrations for selected pollutants as well as the current major sources of air emissions within the Project Area and surrounding region.

4.11.2 Existing Conditions

Sandusky County is not part of a metropolitan planning organization nor does it have a large population such as Lucas County (i.e. Toledo). According to USEPA, Sandusky County is in Attainment for 8-hour standard ozone and particulate matter (PM) 2.5 standard, two of the most common air quality problems of more urban areas. Ballville Township is rural in demographics and land uses with no large industrial sources of poor air emissions or significant traffic issues adding to poor air quality. Operation of the dam does not include any combustible engines and does not negatively add to the air quality.

4.12 NOISE

Noise is generally defined as unwanted sound. Sound travels in mechanical wave motion and produces a sound pressure level. This sound pressure level is commonly measured in decibels (dB), representing the logarithmic increase in sound energy relative to a reference energy level. Sound measurement is further refined by using an A-weighted decibel (dBA) scale to emphasize the range of sound frequencies that are most audible to the human ear (i.e., between 1,000 and 8,000 cycles per second). The dBA scale weighs the various components of noise based on the response of the human ear. Therefore, unless otherwise noted, all decibel measurements presented in this FEIS are dBA. Because sound levels are expressed as relative intensities, multiple sound sources are not directly additive. Rather, the total noise is primarily a result of the source of highest intensity. For example, two sources, each having a noise rating of 50 dBA, would together be heard as 53 dBA, not 100 dBA.

4.12.1 Scope of Analysis

The noise analysis presented in this FEIS addresses a subset of the Project Area and adjacent areas outside of the delineated project area. This analysis focuses on areas with noise receptors that are in radiating bands of 50, 100, 200, 400, 800, 1,600, 3,200, and 6,400 feet in radius from the Ballville Dam and ICS construction area. The noise analysis is based on information from geospatial data (e.g. ArcGIS) and location of noise receptors from the dam.

4.12.2 Existing Conditions

No baseline for ambient noise levels have been established for the Ballville Dam project. At the downstream end of the dam ambient noise is generated by the water falling over the dam. No mechanical noise accompanies the sound of water spilling over the spillway. During higher flows the sound is loud enough to obscure human conversation at a normal voice level when standing next to the dam; however, access to this location is restricted. At the upstream end of the Project Area within the impoundment area ambient sound is low and includes distant traffic from local roadways.

Average daytime existing 1-hour equivalent noise levels (L_{eq}) and nighttime outdoor L_{eq} noise levels were studied by the USEPA's *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (1974) to develop estimated noise levels at various types of receptor locations. The estimated ambient outdoor L_{eq} based on USEPA data, are 40 dBA for daytime and 30 dBA for nighttime noise levels.

4.13 HUMAN HEALTH AND SAFETY

4.13.1 Scope of Analysis

The analysis of health and safely in this FEIS examines the issues related to public health, public water source, and safety as they relate to maintenance or removal of a facility such as the Ballville Dam. The safety issues described in this section are related to operation and/or failure of one or more Project components. Therefore, this analysis is limited to the Project Area and impoundment.

4.13.2 Existing Conditions

The Ballville Dam was built on the Sandusky River between 1911 and 1913. As described in Section 1.3.1.2, the impoundment had been used by the City of Fremont as a raw water supply between 1959 and 2013. It was estimated that in 1959 the impoundment had a water capacity of approximately 200 million gallons (MG) (Finkbeiner, Pettis and Stout 1999). Analysis by Finkbeiner, Pettis and Stout (1999) estimated that in 1999 the existing impoundment storage available for water intake was 75 to 85 MG. This volume reduction was attributed to the amount of sedimentation that had occurred between 1959 and 1993 (Finkbeiner, Pettis and Stout 1999). Evans et al. (2002) estimated the impoundment to be 78 percent capacity for sediment trapping and nearing equilibrium. Based on Evans et al. (2002) and the data presented by Finkbeiner, Pettis and Stout (1999) it is assumed that the impoundment water capacity is approximately 80 MG. Based on the increasing demand of water, decreasing storage capacity of the impoundment, and maintenance needs of the dam, the City initiated investigations to identify and evaluate alternatives and locations for improving or replacing the PWS in 1999 (OEPA 2010). In February 2008, the OEPA issued a Findings and Orders notification to the City citing numerous Ohio Administrative Code (OAC) Rule violations related to the operation of the PWS and water quality of the City's PWS (OEPA 2008). Among the violations were elevated nitrate levels documented from samples taken over a period from June 1999 to June 2007. Nitrates are chemicals that combine with various organic and inorganic compounds that are known to affect infants below six months of age potentially resulting in serious illness and, if untreated, death (USEPA 2012). The City determined that the most cost effective alternative was to construct a new sole source off-channel reservoir. In August 2011, the OEPA revised the original Findings and Orders to provide a schedule for eliminating the nitrate issue based upon the expected date of operation for a raw water reservoir system (OEPA 2011b). OEPA (2011b) also noted continued nitrate level violations during the periods of 2009 and 2010.

In 2009 the City began construction of a 730 MG raw water storage reservoir. This new raw water supply was designed to eliminate exceedances of nitrate regulatory levels; provision adequate storage capacity for water demands; provide reserve under low river flow conditions and emergency supply during any pollution event in the river; reduce large variations in raw water turbidity and organics supplied to the water treatment plant; and provide the option to remove the Ballville Dam (OEPA 2010). While the off-channel reservoir is the primary raw water supply for the City, the impoundment could still provide a limited raw water supply in the event of an emergency or necessity. However, withdrawal would still be influenced by nitrate limits. If the impoundment has a water supply capacity of 80 MG then it could provide a five day supply based on water treatment capacity of 14 MGD capacity.

The Sandusky River is the supply source for the raw water reservoir. An intake pump station houses four raw water pumps, with three rated at 11 MGD and one at 6 MGD resulting in a pumping capacity of 28 MGD. One of the larger pumps would be out of service until a time determined necessary by the City. The pump station is connected to an intake structure along the left bank of the river by a 60 inch (152.4 centimeter) pipe, a screen return pipe with a diameter of 12 inches (30.5 centimeters), and a 3- inch (7.6 centimeter) diameter sampling line (OEPA 2010). This structure is located approximately 6,000 feet (1,828.8 meters) upstream of the dam on the west side of the Sandusky River between the pump station and the river. The intake structure is approximately 50 feet (15.2 meters) in length (end of apron to intake pipe) and located within the west bank of the Sandusky River. It is 17 feet (5.2 meters) tall from bottom of intake pipe to top of structure. Additionally, a portion of the intake structure is covered to protect it from falling debris. The bottom of the 60 in intake pipe is located at 610.5 feet above mean sea level (AMSL) (186.1 meters) and 2.5 feet (0.8 meters) below the elevation of the existing bedrock river bottom. The surrounding apron is 25 feet (7.6 meters) long and declines 2.5 feet to direct water from the river to the intake pipe during low flow conditions. The apron varies in width and is 29 feet (8.8 meters) wide at level with bedrock and 20 feet (6.1 meters) wide at the covered portion of the structure. The current average pool elevation at this location is 625 feet (190.5 meters) AMSL (ARCADIS Intake Structure Structural Sections and Details Record Drawing 11-05-12).

The off channel reservoir eliminates the issues with increased nitrate levels in the PWS that occur annually by controlling when water is drawn. The Ballville Dam impoundment had numerous nitrate level violations during the periods of 2009 and 2010 and presented a health risk to the general population. The new reservoir, which came online in February, 2013, has the capacity to supply 730 million gallons of water. By removing the raw water intake from the impoundment and having it come from an off-channel reservoir the City is able to regulate nitrate levels by only drawing raw water from the Sandusky River when nitrate levels are relatively low. In addition to nitrate concentrations, operational procedures for the intake include: 1) withdrawals during periods where turbidity concentrations are less than 200 NTU’s and 2) no nighttime withdrawals during April, May, and June to minimize larval fish entrainment (City of Fremont Operation, Maintenance and Inspection Manual for Raw Water Reservoir 2012).

The off-channel raw water reservoir was constructed to be the City's raw water source. The reservoir was constructed to alleviate nitrate level exceedances in water supply, provide the City with a dependable raw water source during low flow periods of the Sandusky River, and provide for restoration of the Sandusky River by removal of the Ballville Dam. While the Ballville Dam currently has the infrastructure to provide raw water for the City, it has not been used as a raw water source since the off-channel reservoir was completed.

The Dam is classified by the ODNR as a Class I structure. This classification is the highest hazard rating due to the probable loss of life if the dam were to fail during a flood event. The dam and impoundment pose substantial safety hazards and health risks to the people of Fremont, Ballville Township, and Sandusky County. The aging and deteriorating dam and adjacent sea wall do not meet State of Ohio dam safety regulations. The dam also poses a drowning hazard for swimmers and boaters. Progressive deterioration of the dam and associated sea wall has been noted in successive inspections beginning in 1980, however the last known maintenance performed on the structure occurred in 1969 (ODNR 1981; ODNR 1999; ODNR 2003; ARCADIS 2005). ARCADIS (2005) investigated the dam based on ODNR's inspection report (ODNR 2003) primarily assessing the ability of the dam to withstand a design flood and deterioration of the concrete structures. ARCADIS (2005) found that the sea wall is unable to safely pass the probable maximum flood. Overtopping of the seawall occurs at approximately 50,000 cubic feet per second, or 25 percent of the probable maximum flood. Additionally, the considerable deterioration of concrete repairs from 1969 and undercutting along the downstream toe of the spillway sections and central non-overflow section were observed. While these conditions do not presently endanger the stability and serviceability of the dam, left unchecked the conditions are likely to degrade and eventually compromise the stability and serviceability of the structure (ARCADIS 2005).

In August 2007, the ODNR issued a Notice of Violation (NOV) to the City stating that, as a result of its poor condition, the dam was being operated in violation of the law. In June 2011, the ODNR extended timeframes for bringing the dam into compliance (ODNR 2011b) in recognition that a new Public Water System reservoir was being completed. This letter noted that extension of the schedule for compliance did not remedy concerns regarding the condition of the dam.

5.0 Environmental Consequences

This chapter describes and compares the environmental impacts of each of the four alternatives identified in Section 3.1 carried forward for detailed analysis. Each section of this chapter details, by resource, the impacts as they are understood for each of the alternatives including the Proposed Action. The impacts identified in this chapter are based on technical reports and analyses, which are included as appendices and cited as appropriate.

The following terms define the primary analysis for this FEIS. **Construction** refers to all activities carried out during any of the four alternatives. Construction does not end until all activities have been completed and no work remains outside of operation and maintenance. **Post-Construction** refers to the time after construction has been completed. This includes operation and maintenance. **Mitigation Measures** are those actions that are carried out in order to lessen the impact or effect of a particular action.

5.1 PHYSIOGRAPHY, GEOLOGY, AND SOILS

5.1.1 Impact Criteria

This analysis evaluates how the four alternatives would potentially impact existing geologic resources in and around the Ballville Dam. There are no specific federal regulations pertaining to physiography, geology, and soils pertinent to their analysis: however, impacts on soils can have indirect effects on other resources, and NEPA and CEQ guidelines state that protection of unique geological features and minimization of soil erosion must be considered when evaluating impacts of the Project and alternatives.

5.1.2 Proposed Action

5.1.2.1 Construction Effects

Impacts to physiography, geology, and soils are limited to the sediment transport that would be expected to occur as a result of construction of access roads, notching and removing the dam, construction of the ice control structure (ICS) and rehabilitation of the seawall. Some bank sloughing may occur after the impoundment is dewatered and a new river channel forms.

Phase 1 would construct an access road to the south abutment to notch the dam. Minor impacts to physiography, geology, and soils are expected from the access road and work pad construction. Clean fill brought from off-site would be used for all access roads, ramps, and workpads as needed. The work pad at the south abutment would be approximately 0.5 acres (0.2 hectares) in size. Approximately half of the work pad is wooded and would require tree removal. Limited onsite grading would be required to ensure a level work pad to safely use a trackhoe for Phase 1 notching of the dam. Soil erosion measures, such as silt fencing, would be put into place to prevent any erosion and sediment entry into the Sandusky River due to clearing and grading at the work pad. The work pad would serve as access to notch the dam that would produce a base level change on pool elevation from 625 to 615 feet (190.5 to 187.5 meters) at low flows. The upstream channel within the former pool would be expected to respond to this new elevation control with a series of adjustments such as upstream knickpoint migration (i.e. a localized area of high channel slope that is often a focal point for channel adjustments), incision, and subsequent widening (Appendix A11). This cycle of knickpoint migration, incision, and widening would likely occur repeatedly as the eroding sediments are washed downstream until a new stable bed elevation is achieved along the length of the current impoundment. However, it is possible that the next phase of dam demolition would begin before the process of adjustment is complete. Fine-grained sediments would be mobilized and exported to downstream reaches during and immediately after construction associated with the notch. The magnitude of sediment export would be limited by the relatively small hydraulic capacity of the notch and may not differ substantially from the existing normal river condition. Coarse-grained sediments, if present, are not expected to pass over the dam. Additional sediment would be exported by storm-generated stream flows in the months following the notch.

The notch strategy is intended to diminish the initial delivery of sediment to downstream reaches by limiting the depth of incision to elevation 615 feet (187.5 meters) rather than the much lower bedrock elevation of 596 feet (181.7 meters). This strategy also constrains storm driven sediment export because the impoundment would maintain backwater conditions during higher flows. The dimensions of the notch are only large enough to convey approximately 2,000 cfs, which is large enough for approximately 90 percent of the summer and autumn discharge values. Larger flows would continue to produce backwater conditions behind the dam. While the notch is being created, rubble from the dam would not be expected to transport downstream. Smaller pieces, the size of gravel, could potentially transport but would not be expected to occur in measureable volumes.

The remainder of Ballville Dam would be demolished during Phase 2. Channel adjustment and sediment export would follow similar processes described above. However, channel incision would be constrained by currently submerged bedrock outcrops rather than the dam. A pulse of stored sediment would be exported to downstream reaches during the demolition process. An expected impact resulting from the release of impounded sediment into the Sandusky River is aggradation. Aggradation is a geological term to describe how land elevation increases due to deposition of sediment. Most (greater than 99%) of the accumulated sediment in the dam impoundment is comprised of material finer than sand (diameter of less 0.25 millimeters). Subsequent pulses would be mobilized during storm generated high flow events. The impoundment would no longer constrain the physical forces necessary to mobilize and transport coarse-grained substrates.

Phase 2 would also attempt to stabilize approximately 20 acres (8.1 hectares) of newly exposed sediment previously inundated by the impoundment. Stabilization measures would be used to prevent erosion. These measures include seeding and vegetative strategies designed to control invasive plant colonization. A planting plan was designed detailing a planting list (common name, Latin name, and wetland indicator) for each seed mixture species and the estimated seeding rate (Appendix A6). The planting plan would be part of the Section 404/401 Clean Water Act permit application and water quality certification process. Construction plans would include the planting plan, which details planting zones, cost estimates, environmental covenant, and plant species list to be used.

A second access on the north side of the river downstream of the dam would include the installation of an access ramp to continue demolition of the structure (Section 5.2.2.1 for impact quantities). As this ramp is being built so would the ICS. The ICS consists of a total of 15 piers spaced 21 feet (6.4 meters) apart (on center) composed of approximately 390 CY of tremie concrete in drilled shafts. Bedrock removed from the drilled shafts would be transported from the site.

After completion of the ICS, demolition of the dam would commence. Approximately 15,000 CY of dam rubble would be removed, of which potentially 1,900 CY could be used to fill scour holes below the existing dam. Rubble from the dam is not expected to transport downstream. Smaller pieces, the size of gravel, could potentially transport but would not be expected to occur in measureable volumes.

Phase 3 of the Proposed Action includes modification of the sea wall and restoration of the project area after dam removal. The seawall is approximately 702 feet (214 meters) long and 1.5 feet (0.5 meters) wide with an average height of five feet. The sea wall would be reduced in height, mechanically, to the existing land side grade. The remaining seawall portion below the existing land side grade would be kept in place. Approximately 195 CY of concrete would be removed from the project area and disposed of appropriately offsite (i.e. landfill). No earthwork or in-water work would be required to modify the seawall.

After all temporary construction material has been moved offsite, grading and seeding of the newly exposed riverbanks would be completed (Appendix 6). Erosion control best management practices (BMPs) would be defined and implemented from appropriate permits to avoid if possible, but minimize if unavoidable, impacts to the Sandusky River.

As the Sandusky River assumes its new channel width and depth, some erosion could occur during storm events within the former impounded area. To the degree practicable, plantings would be used to help control erosive conditions.

Lastly, the presence and condition or absence of Tucker Dam would be confirmed following the initial drawdown from construction of the notch. This structure would need to be demolished, if intact, to allow for fish passage to upstream reaches. Demolition would be designed at that time to minimize additional erosive conditions.

5.1.2.2 Post-Construction Effects

Demolition of Ballville Dam and the subsequent release of sediments would likely result in localized accumulation (aggradation) of sediment downstream from the dam (Stantec 2011b).

Sediment transport dynamics are described in detail in Appendix A11. The channel is expected to reach a relatively stable position within one to two years of the complete removal. The data presented in Major et al. (2012) demonstrated that approximately 50 percent of the stored sediment volume was exported in the first year after removal, but only six percent in the second year despite much higher flows. The small magnitude of export in the second year is an indication of a channel approaching stability. The volume of sediment estimated for export is 450,000 – 700,000 CY.

Prior studies of dam removal have documented the formation of a "sediment wedge" from the released sediment (Appendix A11). Sediment transport modeling conducted by Stantec (2011b) suggests that depths of sediment aggradation would vary spatially. The results of the 1-dimensional sediment transport analysis indicate that the maximum height of aggraded sediment from an immediate release of the entire sediment wedge (840,000 CY) would be approximately 2.5 feet (0.8 meters) in the reach of the river confined by levees through Fremont; however, typical depths of sediment would be less than 1 foot (0.3 meters). It is important to note that this analysis did not include evaluation of localized aggradation, which could result in greater reductions in depth. The maximum sediment aggradation depths were calculated during summer low flows; the stream power generated by the river through the leveed section even during small flood events (i.e. the 5- or 10-year flow), however, is sufficient to transport enough volume of sediment to bring the channel back to pre-dam breach conditions. It should be noted that the proposed action was designed to result in the release of smaller volumes of sediment over a longer time frame (not one event) by phasing in the removal and stabilizing the exposed sediment by seeding and vegetative plantings. This is expected to minimize the size of the sediment wedge and the magnitude of suspended sediment associated with any given storm event (Appendix A11).

Regardless of the sediment wedge's initial size and position, it would be expected to degrade over time as it migrates downstream and as sediment is redistributed over a larger area with each successive high flow event. The rate of wedge migration and sediment dispersal would be dependent upon the flow regime over a period of years following removal of the dam. If the dam removal is followed by a succession of high flow events, the rate of wedge migration and sediment redistribution would be more rapid. If flows are low, the channel would likely respond less quickly.

The sediment wedge would not be expected to form immediately below the dam due to the small grain size of the sediment stored in the pool, as well as the relatively steep gradient of the river reach between the dam and flood control levee section. Some sediment may deposit in the levee section during low flows, however, the absence of a floodplain (due to the levee confinement) greatly increases near bed shear stresses and stream power during higher flows. Consequently, high flow sediment transport capacity would be expected to be very high in this part of the Sandusky River. The effect of the sediment wedge diminishes with distance from the dam due to: (1) the dispersal of sediment over a larger area; (2) deposition of sediments on bars, islands, and floodplains; and (3) the export of the smallest particles to Lake Erie. The reach of the river near Brady's Island is potentially susceptible to sediment aggradation, particularly the side channel on the eastern end of the island. Short-term impacts to motorized watercraft navigation could occur in this reach near Brady's Island, and elsewhere in the lower river depending on water levels and water volumes. These impacts may inhibit movement of larger recreational boats. Smaller slip-boats such as Jon boats, canoes, and kayaks are not as likely to experience impacts. The magnitude and duration of the impacts depends heavily on precipitation events after dam removal. Sediment would be flushed through the system with 'large" rain events, but if the weather is dry, it may lead to longer periods of sediment aggradation in this area.

Impacts to navigation in the Sandusky River, Muddy Bay, and Sandusky Bay may be placed in perspective by comparing the sediment volume stored by Ballville Dam to the total surface area available for deposition. Based on other studies of dam removal, if it is assumed that approximately 470,400 CY would be exported following dam removal (approximately half the sediment stored [consistent with Major et al. 2012]) and that sediment would deposit on less than ¼ of the surface area of average flow wetted stream channel available, resulting in a depth of deposition of approximately 3/8 of an inch (1 centimeter). Consequently, it is unlikely that the Ballville Dam removal would cause long term impacts to navigation. It is also important to recognize that sediment loading from removal of the dam would be small in comparison to loading from the Sandusky River watershed. It is currently estimated that 840,000 CY of sediment are stored in the impoundment (Stantec 2011b). Between 1979 and 2002, the Sandusky River watershed delivered 8,828,000 CY yards of sediment to the USGS Gauge 0419800 located at Tindall Bridge. Although events do occur in the Sandusky River where approximately 867,000 CY were delivered by the watershed in a single year and 143,000 CY in a single day (Stantec 2011b), the mean annual load is approximately 368,000 CY, nearly half the estimated volume of material currently stored in the impoundment (840,000 CY). While dam removal would contribute sediment to the river, Muddy Bay, and Sandusky Bay, the load added by construction activities at the dam site would remain within the natural range of variation for the watershed recorded for most years. Sandusky Bay is periodically dredged for navigation. Currently, the USACE is planning to conduct maintenance dredging of shipping lanes in the eastern part of the Bay near the Lake Erie connection in 2014. It is not expected that the Proposed Action would impact these actions or accelerate the dredging schedule based on the natural range of variation in the watershed.

The Sandusky River's hydraulic conveyance would be bound by the bedrock river bottom and a new incision channel through the sediment stored behind the dam. The Proposed Action would provide a small level of assistance in training of the river and creating a new thalweg (i.e. line of lowest elevation within a watercourse); however, the channel would determine its own course based on water volume and velocity. It is expected that the river would be confined to its historic channel between the existing banks although may not stabilize its location for several storm events, seasons, or years.

As described in Section 4.2.2.4.4, a comparison of the metal concentrations in Ballville sediments, normalized for aluminum, to those in recent Lake Erie sediments indicate metal concentrations in the Ballville impoundment sediments are appreciably lower than the concentrations reported from Lake Erie sediments (Evans and Gottgens 2007). Following removal of the Ballville Dam, sediment would be resuspended and transported downstream. However, the potential adverse effects on the aquatic life are predicted to be minimum and short-term.

Several factors strongly influence the distribution and potential for toxic effects for sediment-borne contamination. Fine-grained clay particles, like those present in the Ballville impoundment watershed, are more likely to be transported in runoff but are also more capable of adsorbing sediment-borne pollutants. Clay soils are typically high in aluminum silicates, however, the presence of aluminum, phosphorus, heavy metals or DDT breakdown products in sediment, does not mean that these compounds would be chemically available to downstream ecosystems.

The Sandusky River watershed is about 90 percent agricultural and the application of lime to agricultural soil is a standard practice in the area (USDA 1987). The use of lime as a soil amendment reduces soil acidity (i.e. increases soil pH) which greatly influences the concentration and chemical availability of many dissolved metal ions. Higher soil pH makes a variety of plant nutrients, including phosphorus, more available but simultaneously decreases the concentration of chemically active aluminum (Al^{3+}). This balance suggests that the release of stored sediments should have minimal effect on downstream ecosystems.

5.1.2.3 Mitigation Measures

Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects such as soil erosion, resulting from construction. Erosion control and stormwater management would be required during construction through the National Pollutant Discharge Elimination System (NPDES) permitting program. Additionally, any work in the Sandusky River would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by the Ohio Environmental Protection Agency (OEPA; Section 401 Clean Water Act). Additionally, the “notch” approach with a two-year timeframe for removing the dam and seeding the former impoundment while it is being drawn down would minimize sediment movement when the dam is removed.

5.1.3 Alternative 1 – No Action Alternative

5.1.3.1 Construction Effects

There would be no geological or soil impacts during the dam rehabilitation phase of the No Action Alternative since there would be no changes to the existing shoreline. Annual operation of the “lake drain,” or sluice gates would not result in an appreciable release of sediment. This action is not intended for annual drawdown but to ensure their operation.

Rehabilitation of the sea wall would require earth moving to stabilize the structure. However, this action would not threaten to erode or wash sediment into the Sandusky River as all soil disturbances would occur on the north side of the seawall. Access to the dam to perform the repair and maintenance work would be on property owned by the City of Fremont. The wall is approximately 702 feet (214 meters) long and 1.5 feet (0.5 meters) wide with an average height of five feet. Soil behind the sea wall would be removed down to rock and replaced with a non-erodible material such as roller-compacted concrete that would remain stable during a cresting of the wall. The removed soil would be properly disposed of off-site.

5.1.3.2 Post-Construction Effects

There would be no changes to geology or soil from the operational phase of the No Action Alternative. Sediment stored behind the dam would remain in place with minimal, if any, discharge during annual lake drain testing.

5.1.3.3 Mitigation Measures

Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects resulting from construction, such as soil erosion. Erosion control and stormwater management is required during construction through the NPDES permitting program. Additionally, any work in the Sandusky River would require a USACE Section 404 Clean Water Act and Section 10 Rivers and Harbors Act permit and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act).

5.1.4 Alternative 2 – Rehabilitate Dam, Install Fish Passage Structure

5.1.4.1 Construction Effects

There would be no geological or soil effects of the dam repair and rehabilitation phase of Alternative 2. The effects of the rehabilitation of the seawall would be the same as Alternative 1 (Section 5.1.3.1). Work to construct the fish passage structure and sorting facility would be on existing property. The land adjacent to the north abutment of the dam where the trap system, lifting system, and the sort/count facility would be constructed has been disturbed by construction activities in the past, particularly surrounding the former power plant. The elevator-style fish passage facility would require the following: installation of coffer dams; excavation of a collection tailrace below the dam, installation of fishway foundation elements, installation of the steel superstructure, fishway controls, control date, and volitional channel; and the construction of an upstream inverse grade canal, or fishpass outlet, and the sorting building (Figure 3-3 for the conceptual design). Excavation would occur at the north end of the dam, on the downstream side in the channel to construct a collection tailrace. Also, the construction of the fishpass outlet would require earthwork from the dam to approximately 100 feet (30.5 meters) upstream on the north side of the river (Figure 3-3).

5.1.4.2 Post-Construction Effects

There would be no long-term impacts to geology and soils as a result of the rehabilitation of the dam and installation of the fish elevator. Operation of the structure would require maintaining fishway controls, but no earthwork or dredging is expected to be needed to conduct maintenance.

5.1.4.3 Mitigation Measures

Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects resulting from construction, such as soil erosion. Erosion control and stormwater management is required during construction through the NPDES permitting program. Additionally, any work in the Sandusky River would require a USACE Section 404 Clean Water Act and Section 10 Rivers and Harbors Act permit and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act).

5.1.5 Alternative 3 – Dam Removal with Ice Control Structure (ICS)

5.1.5.1 Construction Effects

Impacts to physiography, geology, and soils would be the same as the Proposed Action, Section 5.1.2.1., with the exception that the timeframe of implementing dam removal would be more compressed and sediment behind the dam would be released in one event instead of the notch approach in the Proposed Action. The construction for Alternative 3 would occur in one year. Under Alternative 3, elevated concentrations of suspended solids would be continuous for the duration of construction. Additionally, there would be potential to export more sediment immediately following the removal of the dam in Alternative 3 because the breach and removal occur during one continuous event. Further, because seeding would not occur until the impoundment was completely drawn down and the river had established a channel, more export of sediment may occur in this Alternative than in the Proposed Action.

5.1.5.2 Post-Construction Effects

Post-construction effects on physiography, geology, and soils are the same as those described in the Proposed Action, Section 5.1.2.2. Alternative 3, however, is designed to be executed in a shorter time period, and there would be less time to allow the sediment in the former impoundment to stabilize. Additionally, there would be more potential to export sediment from the former impoundment immediately following dam removal, flushing more sediment downstream over a shorter time period. There would likely be greater aggradation of sediment downstream of the dam in this alternative, because sediment would be mobilized in one event without a period of time to become stabilized.

5.1.5.3 Mitigation Measures

Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects resulting from construction, such as soil erosion. These BMPs include seeding and vegetative strategies designed to control invasive plant colonization in the former impoundment. Erosion control and stormwater management is required during construction through the NPDES permitting program. Additionally, any work in the Sandusky River would require a USACE Section 404 Clean Water Act and Section 10 Rivers and Harbors Act permit and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act).

5.2 WATER RESOURCES

5.2.1 Impact Criteria

This analysis evaluates how the four alternatives would potentially affect existing water resources. Water resources evaluated include surface waters (i.e. river and streams), wetlands, floodplain, and groundwater. Project effects to water resources would be considered significant should any of the following result:

- Lost function of wetlands, streams, and/or floodplain;
- Compromised safety or quantity of groundwater;
- Degraded aquatic resources that result in losses in biodiversity or degraded water quality or quantity; or
- Dramatic changes to other resources, such as flora or fauna, either beneficial or damaging related to affected water resources conditions.

At the Federal level, water resource impacts are regulated by the Federal Water Pollution Control Act (Clean Water Act) of 1972, Executive Order 11988: Floodplain Management (1977), Executive Order 11990: Protection of Wetlands, Wild and Scenic Rivers Act of 1968, and the Safe Drinking Water Act of 1974. In addition, state and local agencies have developed legislation that regulates water quality, discharges, and floodplain development within the state. This includes its designation as a State of Ohio Scenic River. Impacts to water resources are discussed in the following sections as either direct or indirect. Direct impacts refer to construction activities that require the direct placement or excavation of fill materials. Indirect impacts or secondary impacts refer to hydrologic alteration that may consequentially occur as a result of dam removal. Discussion of raw water supply is included in Section 5.13 Human Health and Safety, Utilities and Public Services, Solid Waste.

5.2.2 Proposed Action

5.2.2.1 Construction Effects

5.2.2.1.1 *Groundwater*

The Proposed Action would result in elimination of the impoundment behind the dam. Dewatering of the pool is not expected to significantly affect the level of water in farm and domestic wells in the vicinity of the dam. The volume of water in the pool is insignificant in relation to the relatively vast water table recharging wells that are within the influence of the pool. According to the ODNR Division of Water “Ground-Water Resources of Sandusky County” map (ODNR 1980); the direction of ground water recharge is toward the river valley from all directions. Simply stated, groundwater flow is not from river to wells, but travels through the wells on the way to the Sandusky River. This ground water movement virtually eliminates any influence that the existing pool may have on water levels of nearby wells. The ODNR map indicates that farm and domestic supply wells in the Ballville Dam vicinity have usually been developed at depths of 70 to 100 feet (21.3 to 30.5 meters). The elevation difference between the level of the dam pool and that average level of ground water at wells near the dam taken over the distance of wells from the pool represents only a slight gradient change, if any, at well locations. Due to this, as well as the direction of ground water transport, no impacts would be expected on local groundwater availability or quality.

5.2.2.1.2 *Surface Water*

A total of five streams, including the Sandusky River, were identified in the project area. Unnamed tributaries upstream of the dam (streams 1 and 2) and downstream of the dam (streams 3 and 4; see Figure 4-2) are not expected to be directly impacted by the Proposed Action. Direct impacts to streams as a result of the Proposed Action would be confined to the Sandusky River.

During Phase 1, rubble from notching the dam would be directed to fall into a scour pool below the foot of the dam. Rubble is not expected to be transported downstream from this location due to its size and location. The primary fill into the Sandusky River would result from the Phase 2 access ramp construction and Phase 2 ICS construction. The ramp is estimated to be 7,400 CY of rock and concrete rubble. The ICS would consist of nearly 390 CY of concrete installed into 15 piers. The entire volume of debris from demolition of the dam is estimated to be 15,000 CY. Metal materials in the dam such as the old penstock, sluice gates, and raw water intake apparatus would be removed from the demolition area upon extraction. Approximately 1,900 CY of clean concrete rubble fill from the demolition would remain permanently in two concrete disposal areas that are approximately 0.2 and 0.5 acres (0.1 to 0.2 hectares) in size in order to level the river bed and fill the scour pools. These onsite concrete disposal areas are depicted on Figure 3-1. The remaining clean rubble would be used with other clean fill to complete other channel restoration goals. Other restoration goals could include shaping the floodplain topography to promote the formation of fringe wetlands and/or floodplain wetlands, addressing rilling or gully formation on exposed sediments upstream of the dam, or other adaptive actions to address erosion or habitat enhancements as upstream river conditions change (Also see Section 5.2.2.3.4). Approximately 28,000 CY of fill would be needed to reshape and guide the river channel after dam removal and installation of the ICS. This fill would be placed in and along approximately 866 linear feet of the Sandusky River, and would cover approximately 4.38 acres.

It would be expected that suspended sediment concentrations would be largely influenced by storm events. High suspended solids concentrations would be present after storm events but return to normal levels quickly with decreasing discharge. Measureable effects of the dam removal activities are expected to dissipate within six to 12 miles downstream of the dam (Appendix A11). Impacts to surface water quality would be expected to return to normal as sediment moves through the system.

Indirect impacts to streams due to hydrology alteration would occur upstream of the dam on both the Sandusky River and streams 1 and 2 (Figure 4-2). The impoundment would be drawn down, after notching of the dam during Phase 1, which would decrease the Sandusky River channel width. The linear feet of unnamed tributaries 1 and 2 are expected to increase as a result of the Sandusky River's new channel alignment. Stream functions are not expected to change; only their lengths. Downstream of the demolition area and ICS location are two unnamed tributaries (streams 3 and 4). These streams are not expected to be impacted by the Proposed Action directly or indirectly. Their location and functions are expected to be unchanged.

During the public comment period on the DEIS, concerns were expressed that if the Ballville impoundment were drawn down, flow to the intake for the upground reservoir may be diverted. The design of the intake accounted for the potential dam removal, and this scenario is unlikely to occur. However, should sufficient flows not be reaching the reservoir intake a pilot channel (215 linear feet [65.5 meters], 0.04 acres [0.02 hectares]) would be excavated from the Sandusky River(Figure 5-2) so that flow reaches the reservoir intake.

5.2.2.1.3 *Floodplain*

The effective flood insurance rate maps from FEMA's National Flood Insurance Program that occur within the project area are panels 260, 270 and 280 for Sandusky County, Ohio. Direct permanent fill and excavation would occur surrounding the dam below the elevation of the 1 percent annual chance flood event. Temporary access roads built within the 100 year floodplain would be removed upon completion of construction. A floodplain permit would be necessary for this project.

The potential for flooding from aggradation of sediments is related to areas with reduced flow and increased water surface elevations. The potential for sediments currently stored upstream of Ballville Dam to affect flood conveyance and capacity in the Sandusky River near Fremont was covered in detail by the Ballville Dam Removal Feasibility Study (Stantec 2011b). The potential for increased flooding in Fremont was not identified as a critical issue because of (1) flood capacity associated with the freeboard of the levee system, and (2) the high sediment transport capacity of the river during high flow events.

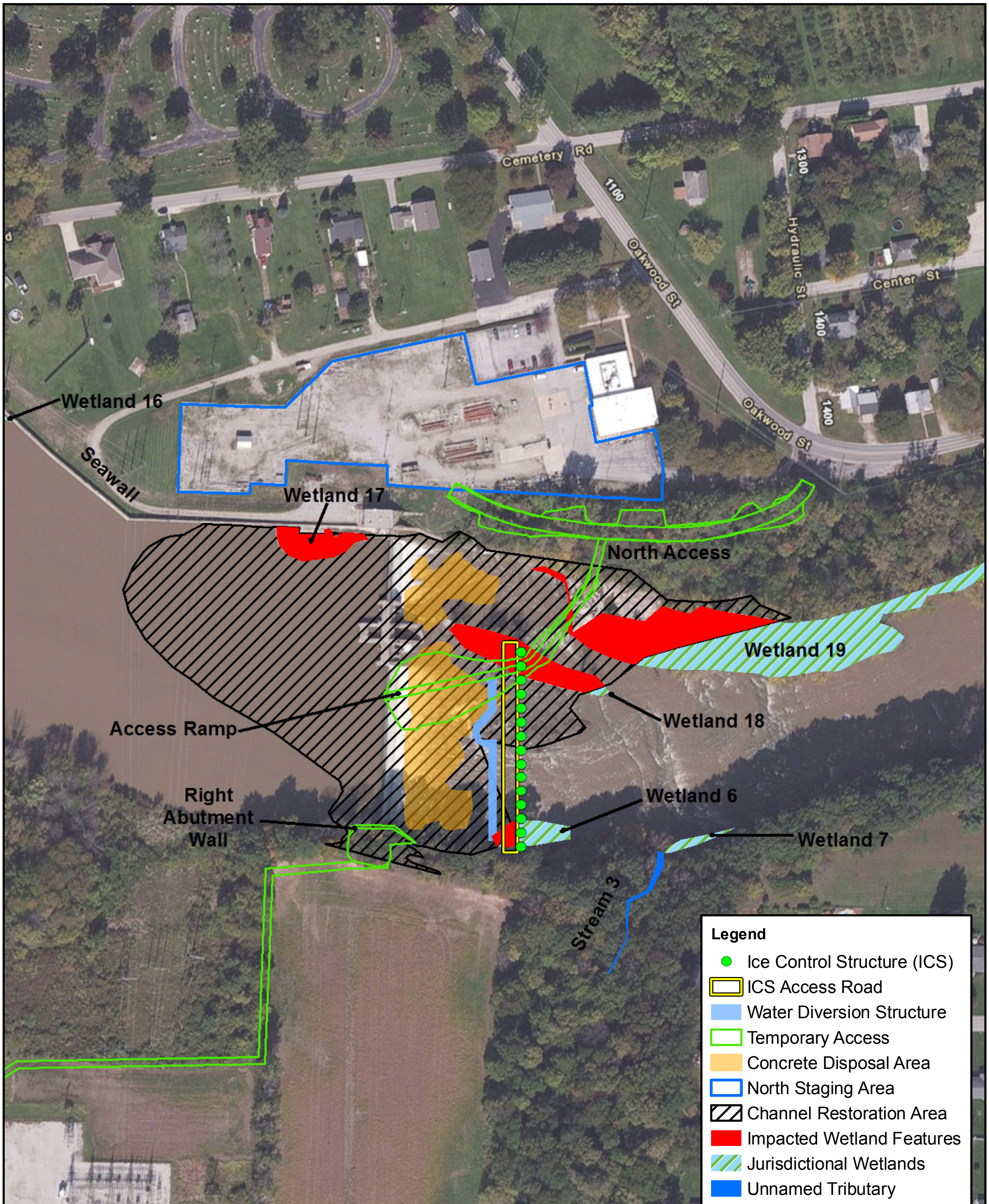
Sediment transport modeling indicates that aggradation of sediment would be likely to occur in downstream reaches, but that this aggradation would not result in increases of water surface elevations in excess of 1 ft. through the leveed reach in Fremont (Appendix A11). This is below the available freeboard within the levee system. High flow events are expected to transport any aggradation from within the leveed section as flow and river bottom sheer stresses increase. To state this in another way, if the "dry" condition occurs and the maximum aggradation is observed, the sediment would be flushed out of the leveed section on the rising limb of the flood hydrograph before the peak flow occurs. In an attempt to predict future events, pronounced sediment aggradation would be likely to occur near the Highway 20 Bridge north of Fremont and could result in a water surface elevation increase of less than 0.1 feet (3 centimeters). Localized shoaling of sediment could occur depending on various factors including, but not limited to, the flow regime, river morphology, and flow obstructions. Impacts to the City's current flood water monitoring protocol and emergency action plan would not be expected.

5.2.2.1.4 *Wetlands*

A total of 20 wetlands were identified within the project area. Six of those wetlands, totaling 0.67 acres, would be directly impacted by the Proposed Action (Table 5-1). The majority of impacts such as temporary fill, permanent fill, and excavation would occur in the close vicinity of the existing dam (Figure 5-1). If needed, some grading activities would occur surrounding the new reservoir intake placing soil fill for bank stabilization in portions of Wetland 14 and 15 (Figure 5-2).

A total of nine wetlands (53.90 acres) would be indirectly impacted as a result of the Proposed Action (Table 5-1; Figure 5-3). Indirect impacts include hydrologic alteration or indirect fill as a result of sediment transport. Wetlands occurring above the dam would have their hydrology altered as a result of the Proposed Action. Although wetland 17 is located above the dam and would receive hydrologic alteration, it is described in Table 5-1 as receiving direct impacts. This is because wetland 17 would be removed during excavation and channel restoration during Phase 3 of the project. Wetlands below the dam would generally receive some fill from sediment transport; however, sediment transport models cannot accurately quantify fill volume per wetland, so it is not included in Table 5-1.

Impacts to wetlands as a result of Phase 1 include only those wetlands influenced by the current impoundment elevation. Phase 1 would notch the dam starting a drawdown of the impoundment nearly 10 ft. The receding of water would cause hydraulic alteration for wetlands along the Sandusky River and the impoundment. The notch would concentrate flows on one side of the dam and would allow demolition to occur under drier conditions. The notch would also draw down the pool level enough for seeding to occur on approximately 20 acres (8.1 hectares) of formerly submerged areas in an attempt to limit erosion and mobilization of fine grained sediment (Figure 5-3).



Basemap:
ESRI

Direct Wetland Impacts Near Ballville Dam

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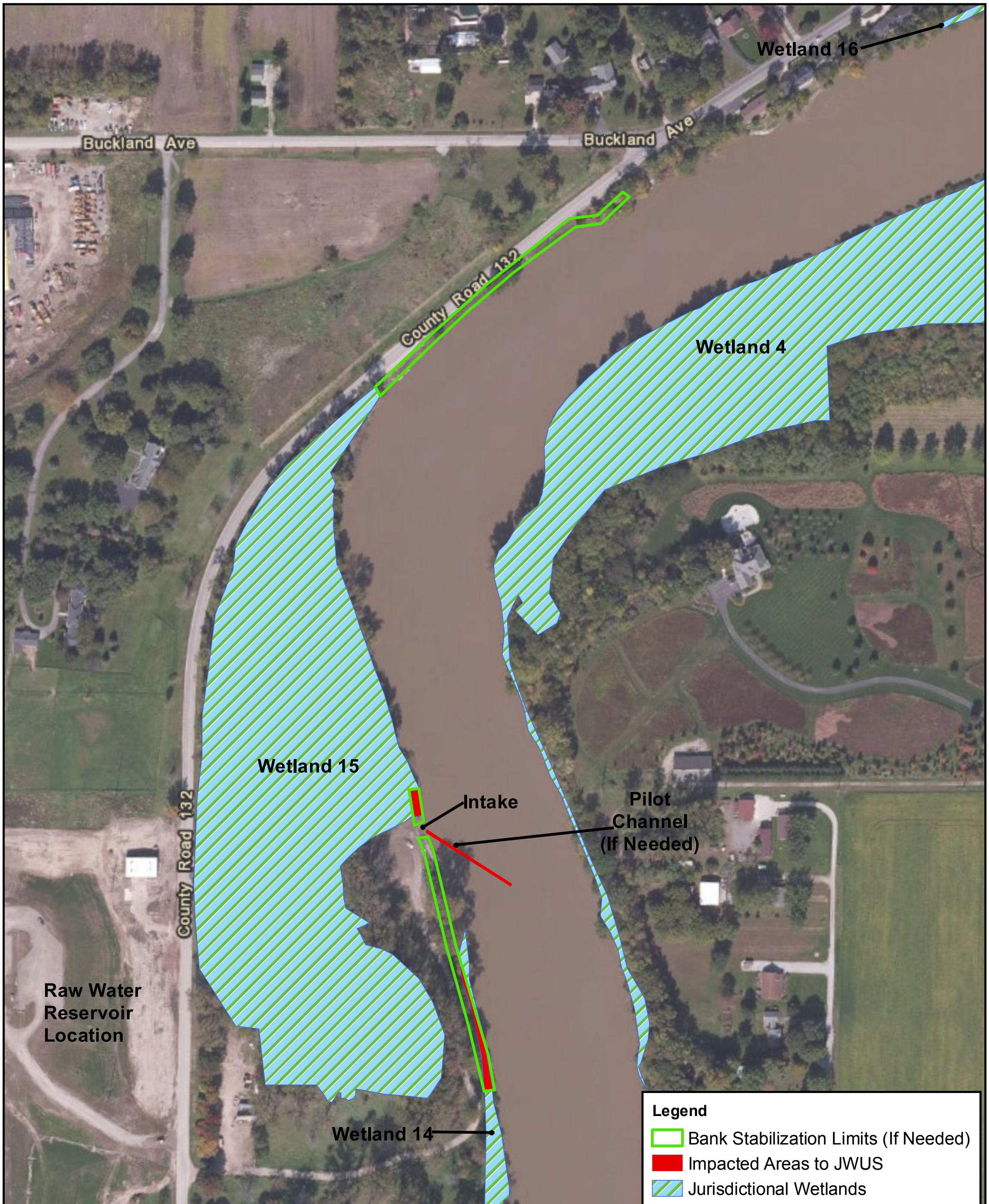
U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

U.S. DEPARTMENT OF THE INTERIOR
MARCH 3, 1849

Ballville Dam Project

0 400 800 Feet

Figure 5-1



Basemap: ESRI

Direct Wetland Impacts Near the Reservoir Intake

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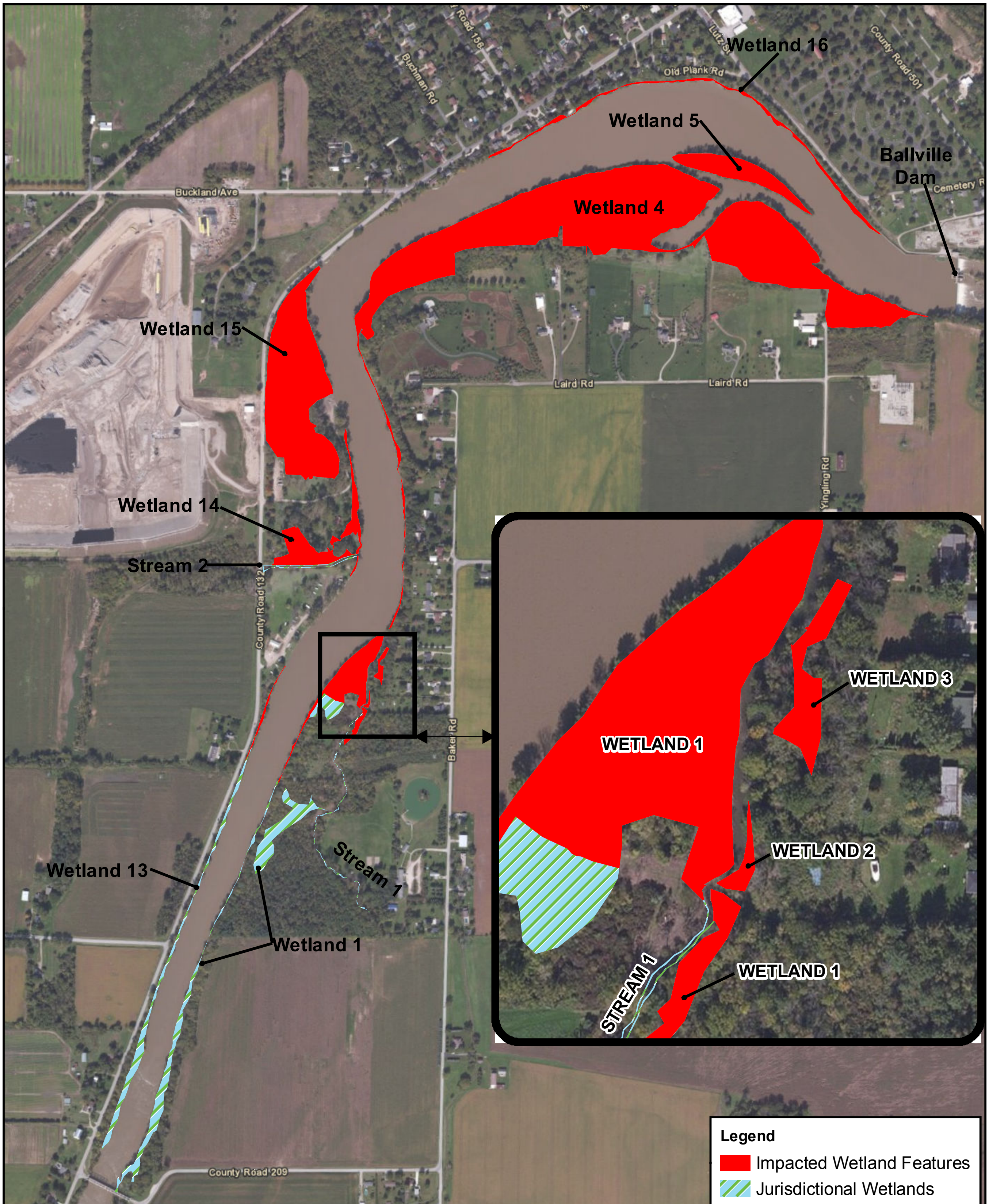
Ballville Dam Project

0 400 800 Feet

Figure 5-2



Basemap:
ESRI

Indirect Wetland Impacts of the Proposed Action

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Ballville Dam Project

0 500 1,000 Feet

Figure 5-3

Table 5-1. Wetland characteristics and impacts associated with the Proposed Action

Wetland ID	ORAM Score	OEPA Category	Wetland Type	Total Wetland Size (acres)	Total Area Directly Impacted (acres)	Description of Direct Impact	Total Area Indirectly Impacted (acres)	Description of Indirect Impact
Wetland 1	71.5	Category 3	Emergent/Scrub-Shrub/Forested	6.29	0	No direct Impact	2.49	Hydrologic alteration
Wetland 2	71.5	Category 3	Emergent/Scrub-Shrub/Forested	0.04	0	No direct Impact	0.04	Hydrologic alteration
Wetland 3	71.5	Category 3	Emergent/Scrub-Shrub/Forested	0.19	0	No direct Impact	0.19	Hydrologic alteration
Wetland 4	71.5	Category 3	Emergent/Scrub-Shrub/Forested	34.11	0	No direct Impact	34.11	Hydrologic alteration
Wetland 5	71.5	Category 3	Emergent/Scrub-Shrub/Forested	2.47	0	No direct Impact	2.47	Hydrologic alteration
Wetland 6	46.5	Category 2	Emergent/Scrub-Shrub	0.08	0.01	Installation of ICS, place soil and rock fill for channel restoration	0	No indirect impact
Wetland 7	44.5	Category 2 (modified)	Emergent	0.02	0	No direct Impact	0	No indirect impact
Wetland 8	68.5	Category 3	Emergent/Scrub-Shrub/Forested	0.9	0	No direct Impact	0	No indirect impact
Wetland 9	68.5	Category 3	Emergent/Scrub-Shrub/Forested	0.18	0	No direct Impact	0	No indirect impact
Wetland 10	68.5	Category 3	Emergent/Scrub-Shrub/Forested	0.04	0	No direct Impact	0	No indirect impact
Wetland 11	68.5	Category 3	Emergent/Scrub-Shrub	0.55	0	No direct Impact	0	No indirect impact
Wetland 12	68.5	Category 3	Emergent/Scrub-Shrub	0.05	0	No direct Impact	0	No indirect impact
Wetland 13	42.5	Category 2 (modified)	Emergent/Scrub-Shrub/Forested	1.68	0	No direct Impact	0.18	Hydrologic alteration
Wetland 14	75	Category 3	Emergent/Scrub-Shrub/Forested	2.47	0.06	Place soil fill for bank stabilization (if needed) near intake for raw water reservoir	2.30	Hydrologic alteration

Table 5-1. Wetland characteristics and impacts associated with the Proposed Action

Wetland ID	ORAM Score	OEPA Category	Wetland Type	Total Wetland Size (acres)	Total Area Directly Impacted (acres)	Description of Direct Impact	Total Area Indirectly Impacted (acres)	Description of Indirect Impact
Wetland 15	75	Category 3	Emergent/Scrub -Shrub/Forested	10.89	0.03	Place soil fill for bank stabilization (if needed) near intake for raw water reservoir	10.89	Hydrologic alteration
Wetland 16	52	Category 2	Emergent/Scrub -Shrub/Forested	1.23	0	No direct Impact	1.23	Hydrologic alteration
Wetland 17	14.5	Category 1	Emergent	0.09	0.09	Remove earth material for channel restoration	0	No indirect impact
Wetland 18	68.5	Category 3	Emergent/Scrub -Shrub/Forested	0.19	0.18	Place rock and soil fill for access ramp, channel restoration, installation of ICS	0	No indirect impact
Wetland 19	68.5	Category 3	Emergent/Scrub -Shrub/Forested	1.87	0.30	Place rock and soil fill for access ramp, channel restoration	0	No indirect impact
Wetland 20	68.5	Category 3	Emergent/Scrub -Shrub/Forested	0.03	0	No direct Impact	0	No indirect impact
				Total	**0.67 acres direct impact**		**53.9 acres indirect impact**	

The majority of direct impacts to wetlands would occur during Phase 2. During this phase an access road from the north and an access ramp to the top of the southern overflow portion of the dam would be constructed (Section 3.1.1.2.2). The access road and ramp would directly impact 0.18 acres (0.07 hectares) of wetland 18 and 0.30 acres (0.12 hectares) of wetland 19 by placing fill temporarily (Table 5-1). This fill would stay in position for at least 12 months during ICS construction and dam demolition.

Construction of the ICS would directly impact a total of 0.01 acres (0.004 hectares) of wetland 6. Impacts would result from two piers constructed for ICS and grading as a result of restoration activities associated with Phase 3.

There are a total of 3.89 acres (1.57 hectares) of delineated wetland within the USACE’s jurisdictional determination survey area downstream of Ballville Dam, which extends approximately 3,200 feet (975.4 meters) downstream. These are primarily riverine wetland systems, as defined by Cowardin et al. (1979), within the main stream channel composed of coarse grained substrates such as cobble, boulder, and bedrock. It appears from the aerial photography that this type of riverine habitat extends approximately another 2,800 feet (853.4 meters) downstream of the jurisdictional survey limit. The wetlands within the jurisdiction survey and the wetlands downstream of the jurisdictional survey area are subject to sedimentation and sediment wedging. Additionally, 0.58 acres (0.23 hectares) of direct impact are expected due to work completed directly adjacent to the dam during construction. The deposition of suspended solids above the dam could potentially deposit and settle along a 20 mile (6.1 kilometer) stretch of the river between Brady's Island to Sandusky Bay.

The primary concern for downstream wetlands is aggradation of sediment. It is not possible to calculate the exact volume of sediment discharge using currently available scientific methods. Sediment transport modeling was performed using hydrologic and sediment data from the USGS gage located upstream of the Ballville Dam at Tindall Bridge. The modeled scenarios included “wet” and “dry” years as well as “heavy” and “light” sediment loading. Results indicate that aggradation of sediment is likely to occur in downstream reaches, but that this aggradation would not result in increases of water surface elevations in excess of 1 foot (0.3 meters) through the leveed reach in Fremont. However, studies from other dam removal projects can be used to place sediment loads in context (Major et al. 2012). Other dam removals have observed 44 percent of total stored sediment volume remaining in place by using a notch approach (Appendix A11). Also see the discussion of sediment deposition in Section 5.1.2.2.

It is expected that most sediment export would occur within the first year following complete demolition of Ballville Dam but could take longer if the magnitude of seasonal storms is small and stream flows are insufficient to transport material. A sediment wedge is expected to form somewhere within the City of Fremont near the transition of the steep bedrock reach and lower gradient part of the Sandusky River. Sediment transport models indicate that the maximum height of aggraded sediment would be approximately 2.5 feet (0.8 meters) in the leveed reach but that typical depths would be less than 1.0 foot (0.3 meters). The effects of the sediment release would gradually diminish over time as sediment is mobilized and redistributed by storm events or would immediately be diminished if a larger storm occurs shortly after dam removal.

Although some additional deposition could occur in the boundaries surrounding the dam, there would be no permanent impact to these wetlands. Therefore, a total of 3.27 acres (1.3 hectares) of delineated wetlands below the dam would only be temporarily impacted by the Proposed Action as sediment is redistributed downstream.

5.2.2.1.5 *Water Quality*

The magnitude and duration of water quality impacts resulting from dam removal depend on many factors including:

- the volume and composition of sediments stored upstream of the dam;
- river discharge at the time of the breach and in the months that follow;
- suspended solids and/or turbidity concentrations at the time of the breach;
- channel slope;
- basin area;
- time that has passed since demolition; and
- the distance from the dam location.

Based on other studies of dam removal, if it is assumed that 470,400 CY (approximately half the sediment stored) would be exported during dam removal and that sediment would deposit on less than ¼ of the surface area available, then the depth of deposition would be approximately 3/8 of an inch (1 centimeter) (following notching of the dam in Phase 1 and removal in Phase 2). Even if the entire volume stored by the impoundment was mobilized, the depth of deposition would be only 2/3 of inch (1.7 centimeters). It is also important to recognize that loading from removal of the dam would be small in comparison to loading from the Sandusky River watershed. It is currently estimated that 840,000 CY are stored in the impoundment. Between 1979 and 2002, the Sandusky River watershed delivered 8,828,000 CY yards of sediment to the USGS Gauge 0419800 located at Tindall Bridge. Approximately 867,000 CY were delivered by the watershed in a single year and 143,000 CY in a single day (Stantec 2011b). The mean annual load is approximately 368,000 CY, nearly half the estimated volume of material currently stored in the impoundment (840,000 CY). While dam removal would contribute sediment to the river, in most years loads would fall within the natural range of variation for the watershed.

Concentrations of suspended solids are not expected to increase appreciably over concentrations observed routinely in the river (Stantec 2011b). When modeling the impacts of release of the stored sediment, it was predicted that in a wet year, high flow concentrations remain in the range of 50 to 500 mg/L (Stantec 2011b). The mean annual daily total suspended solids (TSS) concentration in the period between 1979 and 2002 was 89 mg/L. Observed high flow concentrations in the same period ranged between 109 and 590 mg/L. Impacts to the lower Sandusky River and Lake Erie would be minimized through release during the different phases of the Proposed Action. Minimizing the sediment transport and seeding exposed stored sediment would aid in water quality recovery.

5.2.2.2 Post-construction Effects

5.2.2.2.1 *Groundwater*

Post-construction impacts to groundwater are not expected to occur as a result of the Proposed Action.

5.2.2.2.2 *Surface Water*

The substrate in free flowing portions of the Sandusky River is composed of limestone bedrock with smaller amounts of boulder, cobble, gravel, and sand substrates (OEPA 2011a). As time elapses after the Proposed Action, the coarser substrates upstream of the former impoundment would be transported downstream, improving habitat conditions in the former impoundment and downstream. The former impounded area would be expected to revert to a natural stream channel similar to that above the current impounded area. The banks would, over several growing seasons, become more stable with vegetation establishment (i.e. herbaceous, shrubs, and trees). Width and depths would be similar to above stream reaches as the sediment erosion from the initial notch and dam removal stabilizes. Indices related to physical conditions in the river such as the Qualitative Habitat Evaluation Index (QHEI), and indices related to aquatic live use attainment (Table 4-4) scores would be expected to improve and become more comparable to the current scores both directly upstream and downstream of the impoundment.

The Sandusky River is designated as a Scenic River by the State of Ohio. Under the Proposed Action, this not expected to change, however the placement of the new ICS and shaping of the banks must be considered in regards to this designation. Ohio Revised Code 1547.82 requires that “no political subdivision shall build or enlarge any highway, road, or structure or modify or cause the modification of the channel of any watercourse within a wild, scenic, or recreational river area outside the limits of a municipal corporation without first having obtained approval of the plans… from the director of natural resources or the director's representative.” The Ohio Scenic Rivers Program is within a division of ODNR, and as a cooperating agency our team has coordinated with them to ensure the appropriate steps are taken to meet this designation while also achieving the purpose and needs for the project. No work within the river will occur until ODNR has provided written approval of the work.

5.2.2.2.3 *Floodplain*

Floodplain elevations would decrease in the areas behind the former Ballville Dam as the impoundment dewaters and reverts back to a riverine flow regime. The impounded area would reduce in size to an approximate average width of 175 feet (53.3 meters) wide. The floodplain width would be, in general, consistent through most of the lower Sandusky River until the flood control reach.

The existing one percent annual chance flood event from the Sandusky River would be indirectly modified between the Ballville Dam (DFIRM Panel 260) to Rice Road (DFIRM Panel 270) due to the lowered pool elevation. The wider forested wetlands surrounding the current impoundment would be expected to no longer experience seasonal flooding events, and the water surface elevation of the 100 year flood event would be reduced. Plant communities more conducive to upland environments would be expected to establish in the wider margins of the existing floodplains.

The ICS is designed to catch ice floes and promote ice damming at their location. This utilizes the area behind the former dam location to store ice sheets so that flooding does not occur downstream as a result of ice damming.

5.2.2.2.4 *Wetlands*

A total of 54.57 acres (22.1 hectares) of federally jurisdictional wetlands within the project area would be impacted by the Proposed Action. Direct impact from fill in 0.67 acres of wetland is described in Section 5.2.2.1.4. Indirect impacts would occur as altered hydrology due to the removal of the dam. This area was defined as the area inside the 1-year event or 6,000 cfs (1/2 bankfull volume). Using this model, the acreage of wetlands that would be indirectly impacted by altered hydrology is approximately 53.9 acres (21.8 hectares).

As the Sandusky River establishes a new channel within the former impoundment, wetlands will form along and within the new channel. The model to calculate potential wetland creation was run for three types of wetlands: in-stream, fringe, and forest floodplain. Hydrologic engineering models were completed to predict the future extent of various wetland types in the project area after removal of the dam. This was accomplished using 1) existing wetland data in the project area, 2) topographic and bathymetric data 3) streamflow statistics and 4) hydraulic models characterizing the lateral extent of flood inundation.

<u>In-stream Wetlands.</u> In-stream wetlands occur in the free flowing areas of the river and are a product of river channel deposition and erosion of sediment. When the dam is removed and the impounded area reverts to pre-dam conditions, the potential for the development of in-stream wetland systems is enhanced. The amount of new in-stream wetland habitat was quantified by measuring the length of the impounded area that has the potential of creating this habitat, and summing the amount of existing habitat which included the entire area of Wetlands 6, 9, 10, and 11, as well as portions of Wetlands 19 (Figure 5-4). The formula used to calculate the creation of this wetland type was the following:

$$\frac{(1.74)}{(3{,}135)} = \frac{(x)}{(8{,}676)}$$

Where:

1.74 = the total amount existing in-stream wetland in acres

3,135 = the distance in linear feet along stream centerline of Sandusky River from the dam to the last downstream wetland included in analysis. This is the point where hydrology alteration was estimated to occur among existing wetlands.

x = potential wetland creation in acres

8,676 = the distance in linear feet along stream centerline of Sandusky River from the dam to the point upstream on the river where the existing wetlands are regularly outside the modeled future 6000 cfs flood event. This distance covers the area where potential wetland may develop.

Using this proportional model, the total amount of potential wetland to develop is 4.8 acres (1.9 hectares). There are both Category 2 and 3 wetlands below the dam, so it is expected both types would form with similar functions.

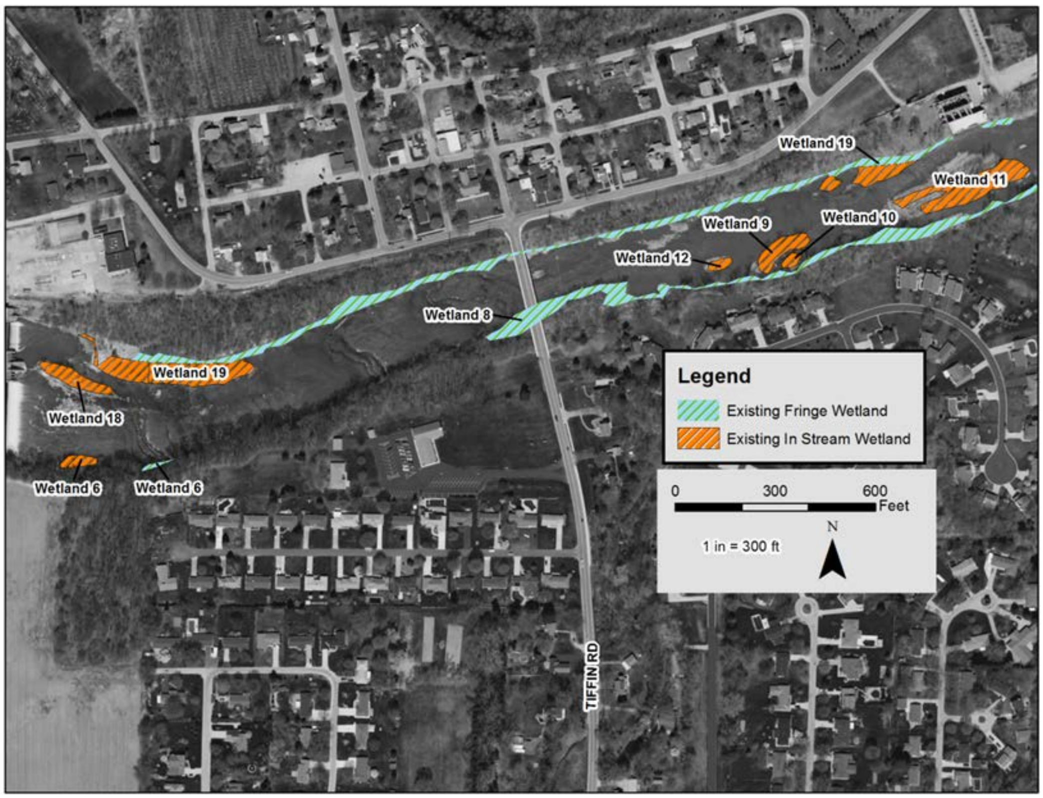


Figure 5-4. Existing In-Stream Wetlands Downstream of Ballville Dam

Fringe Wetlands. Of the 53.9 acres (21.8 hectares) of impacted wetlands upstream of the dam, there are approximately 4.01 acres that currently function as fringe wetland along the Sandusky River. This existing 4.01 acres (1.6 hectares) consists of approximately 1.41 acres (0.6 hectares) of Category 2 wetland and 2.6 of Category 3 wetland.

The development of new fringe wetlands was quantified by abstracting the difference between the future water surface at flood stage (6,000 cfs; 1-year flood event) and the future low flow (300 cfs) water surface (Figure 5-5). There is a potential for approximately 13.2 acres (5.3 hectares) of fringe wetland to develop along the banks of the Sandusky River. Some of these may develop to be long narrow features while others may form as part of a wider forested floodplain.

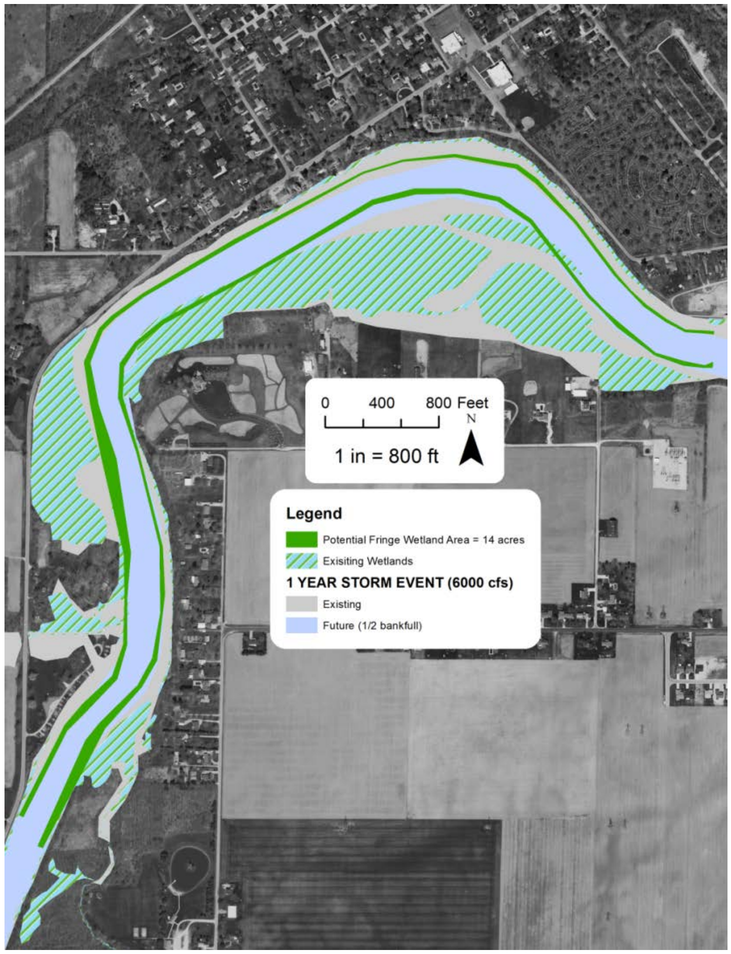


Figure 5-5. Fringe Wetland Potential After Completion of the Proposed Action

Forested Floodplain Wetlands. According to the model, an estimated 49.9 acres (20.2 hectares) of forested floodplain wetlands would revert to upland habitat as a result of no longer receiving annual flooding. The general hydroperiod for floodplain forest is approximately two months out of the year (between February and April the water table is above ground level).

There is the potential for the development of additional forested floodplain wetland habitat surrounding the restored river. After the initial notch of the south spillway, approximately 20.5 acres (8.3 hectares) of exposed sediment would be seeded with native riparian vegetation (Figure 5-6).

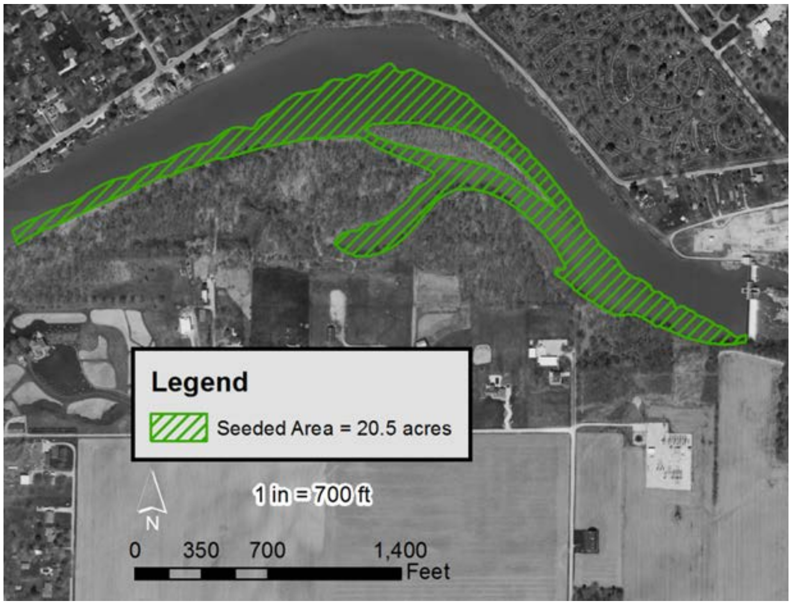


Figure 5-6. Area to be Seeded During Phase 2 of the Proposed Action (Appendix A6)

Additionally, the areas between the extent of the future 6,000 cfs model and the existing stream channel would be comprised of approximately 15.3 acres (6.2 hectares) of exposed sediment (Figure 5-4). This newly exposed area would be managed to promote the establishment of native riparian species. Adaptive management strategies would be used depending on actual exposed areas, substrate, and property ownership.

The City and project partners would seek permission from private landowners, where appropriate, to manage the newly exposed areas to promote the establishment of native riparian canopy species. Adaptive management would be used depending on actual exposed areas, substrate, and property ownership. When combining the two exposed areas (Figure 5-6 and Figure 5-7), a total of 35.8 acres (14.5 hectares) in the former impoundment would become exposed sediment capable of developing riparian vegetation and monitored for wetland formation.

In summary, 49.9 acres (20.2 hectares) of forested floodplain wetland would be subject to indirect impacts from loss of hydrology; potentially 35.8 acres (14.5 hectares) of new wetland could be formed, which totals a net loss of 14 forested floodplain acres (5.7 hectares).

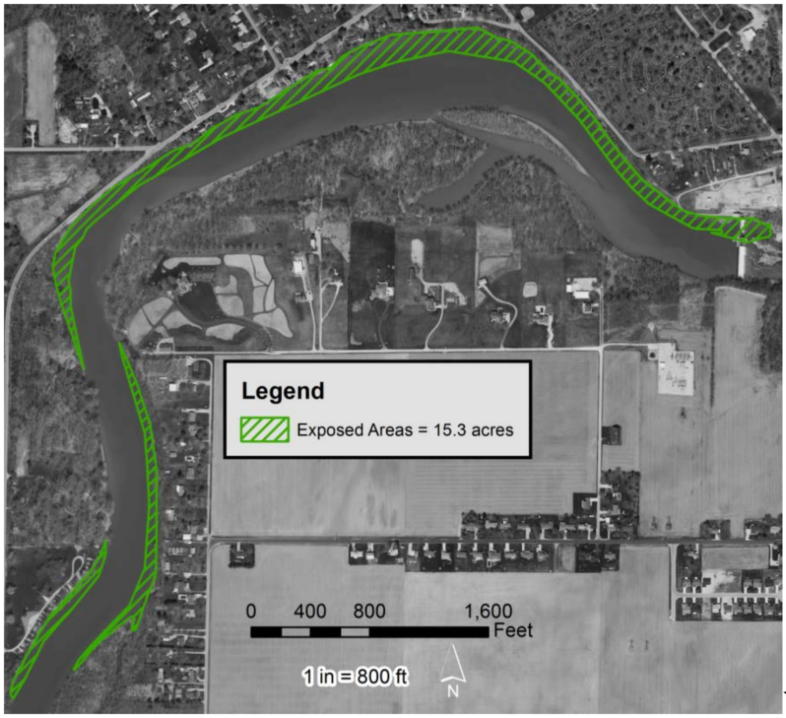


Figure 5-7. Potential Additional Exposed Areas After River Re-alignment

Palustrine Emergent Wetland (PEM) 2. This wetland feature is a small low lying feature (0.04 acres [0.02 hectares]) PEM abutting perennial Stream 1 (Table 5-2). It receives seasonal flooding from backwater flooding from the Sandusky River. After the dam is removed, the hydrology would be altered resulting in the loss of the 0.04 acre PEM wetland.

Table 5-2. Wetland type and acreage before and after the dam is removed showing the net gain/loss of wetlands upstream of the dam.

Wetland Type	Before	After	Net Gain/Loss
In-stream	0.00	4.80	4.80
Fringe	4.01	14.00	9.99
Forest Floodplain	49.90	4.00 to 35.80	-14.10 to -45.90
PEM Wetland 2	0.04	0.00	-0.04
Total	53.95	22.80 to 54.60	**0.65 to -31.15**

In summary, the removal of the dam and restoration of the river to a free-flowing state would potentially result in an increase in acreage of in-stream wetlands and fringe wetlands. However, there would be a loss in acreage of forest floodplain and PEM wetlands due to changes in hydrology. The resulting net loss in wetlands could range from no loss to 31.15 acres (12.6 hectares).

Executive Order 11990, Protection of Wetlands (E.O.) directs that Federal agencies shall "… provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for …providing Federally undertaken, financed, or assisted construction and improvements…" Further, "… each agency, to the extent permitted by law, shall avoid undertaking or providing assistance for new construction located in wetlands unless the head of the agency finds (1) that there is no practicable alternative to such construction, and (2) that the proposed action includes all practicable measures to minimize harm to wetlands which may result from such use." E.O. 11990 also provides for opportunity for public review of plans for new construction in wetlands (including draining of wetlands).

Agencies are directed to consider "factors relevant to a proposal's effect on the survival and quality of the wetlands. Among these factors are: (a) public health, safety, and welfare, including water supply, quality, recharge and discharge; pollution; flood and storm hazards; and sediment and erosion; (b) maintenance of natural systems, including conservation and long term productivity of existing flora and fauna, species and habitat diversity and stability, hydrologic utility, fish, wildlife, timber, and food and fiber resources; and (c) other uses of wetlands in the public interest, including recreational, scientific, and cultural uses."

The Proposed Action would result in some indirect wetland impacts (wetland drainage) from loss of hydrology due to drawdown of the impoundment (included under "New construction" in the E.O.). Some existing wetlands within the impoundment will be dewatered and revert to upland areas, while new wetlands will be created adjacent to the River's new location. The Service is working with project partners to complete the Section 10/404/401 permitting processes, including developing a detailed comprehensive mitigation plan to offset the impact of the potential wetland losses within the Sandusky River ecosystem. Through this permitting process the cooperating agencies will come to an acceptable resolution regarding the impacts to wetlands in the area due to the Proposed Action as we strive for a balanced approach to habitat restoration in the project area.

While the Proposed Action would result in some indirect wetland impacts from loss of hydrology due to drawdown of the impoundment, the Service has also considered whether there are other practicable alternatives to this alternative and what measures could be implemented to minimize harm to the wetlands. In this EIS we fully analyze multiple other alternatives to the action (for summary see Table 6-1) and describe minimization measures for each alternative (EIS Section 5.2.2.3, 5.2.3.3, 5.2.4.3, and 5.2.5.3). Further, the EIS also considers the impacts of the project on the relevant factors described in the E.O. (See Table 6-1).

In summary, though wetland losses may result from loss of hydrology within the former impoundment, the Cooperating agencies are currently working through the Section 10/404/401 permitting processes to develop a comprehensive mitigation plan that will offset wetland impacts within the context of the Sandusky River Ecosystem. The Service has evaluated multiple alternatives, their effects on the human environment, and has engaged the public in review of the alternatives. We believe the Proposed Action is consistent with the intent of the E.O.

5.2.2.2.5 *Water Quality*

The Sandusky River is listed as impaired on the OEPA Clean Water Act Section 303(d) list of impaired waterbodies (OEPA 2012). The 2008 Waterbody Report for Sandusky River Mainstem (State List ID 04100011 001, Downstream Tymochtee Creek to Mouth) states that the impairments to the Sandusky River include flow alterations, habitat alterations, nutrients (nitrate), PCB's in fish tissue, and sedimentation/siltation. Removing the dam would improve habitat conditions by restoring a riverine system to the former impoundment. This action would improve water quality and restore free-flowing riverine habitat that was altered by creation of the impoundment. Additionally, the dam has trapped fine sediment in the impoundment causing excessive siltation at river mile 18.05. Removing the dam would reduce the accumulation of silt and other fine sediments in this reach of the Sandusky River, and restore coarse substrate transport to downstream reaches. Removing the dam would not reduce the input of nutrients into the Sandusky River watershed, nor would it reduce the presence of PCB's in fish tissue. Dam removal is not expected to increase the risk of fish contamination as no PCBs were found in the sediment cores studies from material sampled from the Ballville Dam impoundment sediment (Evans and Gottgens 2007).

As the project concludes and Phase 3 is completed, the Sandusky River connectivity would recover and allow for a natural transport and deposition cycle. This would allow for the riverine habitat to replenish itself and improve its various life use designations, particularly in the former impoundment area. The Sandusky River at RM 18.05 is currently in non-attainment of the Aquatic Designated Life Use Standards due to siltation and direct habitat alteration from the Ballville Dam. Removal of the dam would reduce the accumulation of silt in this reach of the river, and restore coarse substrate transport to downstream reaches. Table 4-4 shows that the IBI, MIwb and ICI indices within the impoundment are lower than those values in areas in full attainment above and below the impoundment. Fish and aquatic macroinvertebrate index scores were below the threshold for warmwater habitat biocritera. The impoundment and conditions that result from the dam alter habitat conditions and impair aquatic communities. Removal of the dam would improve habitat conditions by restoring a riverine system to the former impoundment. Scores of IBI, MIwb, and ICI indices within the former impoundment would be expected, over time, to reflect those scores above the impoundment after dam removal. Removal of the dam would allow the Sandusky River to meet the Aquatic Life Use Attainment values in those areas formerly in non-attainment.

However, because runoff within the watershed is heavily impacted by agricultural practices, the Proposed Action would not reduce the potential for nutrient pulses to occur. Events of nitrate elevation would continue to occur within the Sandusky River due to the agricultural influence in the watershed. However, the Proposed Action would provide for these events to flow downstream more quickly without pooling behind a dam. Additionally, because the Sandusky River would be a free flowing river with no impedance, harmful algal blooms would not be expected to occur. Appropriate performance standards for aquatic life use designation and a timeline would be provided in a formal proposed monitoring report.

5.2.2.3 Mitigation Measures

5.2.2.3.1 *Groundwater*

No impacts would be expected to occur to groundwater resources. Therefore, no mitigation measures would be proposed for groundwater.

5.2.2.3.2 *Surface Waters*

Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects such as soil erosion, resulting from construction that could contribute to sediment deposition. Erosion control and stormwater management is required during construction through the National Pollutant Discharge Elimination System (NPDES) permitting program. Additionally, any work in the Sandusky River would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to ensure no significant impacts occur to wildlife and fisheries. Fill for temporary roads would be removed and the area restored to previous condition. Some fill may be retained for additional grading (Section 3.1.1.2.5). Should the new reservoir intake not have sufficient flows once the dam is removed and impoundment is drawn down, a pilot channel (215 linear feet [65.5 meters], 0.04 acres [0.02 hectares]) would be excavated from the Sandusky River (Figure 5-2) so that flow reaches the reservoir intake.

5.2.2.3.3 *Floodplain*

A letter of map revision (LOMR) would be provided to the Federal Emergency Management Agency (FEMA) to amend their flood mapping resources. Details of that correspondence would be determined in consultation with the local floodplain administrator. Fill for temporary roads within the floodplain would be removed and the area restored to previous conditions. The terms and conditions stated in the floodplain permit would apply.

5.2.2.3.4 *Wetlands*

At a minimum, wetland mitigation would include a holistic mitigation plan based on identified debits and credits to the Sandusky River ecosystem in the immediate area of the Ballville Dam and impound area, as well as to the downstream watershed, in the manner described in the Sections 10/404/401 permit application submitted to the USACE in March 2014. The mitigation plan would be developed in accordance with the USACE's Final Mitigation Rule (40 CFR Part 230).

The Service and the City of Fremont are continuing to work with the USACE and Ohio EPA to develop a mitigation plan that would meet the requirements of Sections 10/404/401 and described in the context of the 401 and 404 permits. This coordination was ongoing at the time of the FEIS (e.g., USACE Public Notice was published on July 2, 2014 and is available at: http://www.egovlink.com/fremont/news/news_info.asp?id=7573; Ohio EPA Public Notice was published on July 19, 2014 and is available at: http://www.epa.ohio.gov/dsw/401/permitting.aspx). The current proposal for wetland mitigation is detailed in the "Ballville Dam Removal and Sandusky River Restoration Project Pre-Construction Notification—401/404 Permit Application" (Application) submitted to the Corps and Ohio EPA, and dated March 6, 2014. Implementation of the mitigation plan would be included as a condition to the 10/404/401 permits. At the time of this FEIS, the wetland mitigation plan had not been finalized so the details of the final mitigation plan are not available.

The USACE would produce an Environmental Assessment (EA) addressing wetlands mitigation before issuing their permit. The USACE will incorporate by reference, relevant portions of the Service FEIS, but will also add additional information where necessary addressing wetlands mitigation before issuing their permit.

Any wetlands that form on property owned by the City of Fremont would be placed in a conservation easement and permanently protected. At this time modeling indicates that the City owns 13.2 acres where wetlands could potentially form.

Additional new wetlands are likely to establish on private property. The City would collaborate with landowners to implement seeding and planting on newly established wetlands, consistent with the Planting Plan (Appendix A6) on these properties similar to those undertaken on City owned property, if the private landowners are willing. If private landowners are willing, these newly established wetlands would be placed in permanent conservation easements as well. At this time the extent of this collaboration is uncertain, however, these wetlands would form and be located adjacent to the currently existing wetlands at these locations. These locations are expected to be seasonally inundated, for approximately 2 months per year, which typically precludes any significant development/disturbance.

The seeding of native wetland vegetation described in the Planting Plan would be implemented to promote wetland development within the former impoundment (Appendix A6).

Clean rubble from demolition will be maintained onsite to potentially be used for adaptive actions such as shaping the floodplain topography to promote the formation of fringe wetlands and/or floodplain wetlands, addressing rilling or gully formation on exposed sediments upstream of the dam, or other actions to address erosion or habitat enhancements as upstream river conditions change.

Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects such as soil erosion, resulting from construction that could contribute to sediment deposition. Erosion control and stormwater management is required during construction through the National Pollutant Discharge Elimination System (NPDES) permitting program.

5.2.2.3.5 *Water Quality*

The Proposed Action would result in short-term increases in suspended solids concentrations that may impact aquatic organisms in downstream reaches of the Sandusky River and potentially into Lake Erie. However, these concentrations are not expected to occur at levels over concentrations which have been observed routinely in the river over the past 50 years (Stantec 2011b; Appendix A11). Further, impacts to the lower Sandusky River and Lake Erie would be minimized through the timing of the demolition.

Demolition activities expected to release sediment into the river would be carried out at the beginning of the wet season, anticipating sufficient flow rate to assist with sediment transport; and when ambient concentrations are already high to reduce the likelihood of an abrupt environmental change or shock to the lower river.

The demolition schedule for the Proposed Action has been designed such that sediment releases would occur during cooler months of the year when the metabolic demand of aquatic organisms is low and oxygen saturation in the water would be higher than during summer. This would assist in minimizing respiratory distress that might occur from elevated suspended solids concentrations. Also, many aquatic insects, amphibians, and other organisms would be entering periods of dormancy (e.g., pupation, aestivation, etc.) during the cooler months of the year.

Consequently, impacts to water quality would be expected as a result of Alternative 3. However, these are minimized by the short-term nature of the planned ICS construction and demolition phase, as well as the use of BMP’s to reduce or eliminate sedimentation during construction.

5.2.3 Alternative 1 – No Action Alternative

5.2.3.1 Construction Effects

5.2.3.1.1 *Groundwater*

No impacts to groundwater resources would be expected to occur as a result of the No Action Alternative.

5.2.3.1.2 *Surface Water*

Activities associated with the No Action Alternative would be temporary in nature. Streams 1, 2, 3, and 4 would not be impacted.

This alterative would have temporary direct effects on existing stream resources. Repairs to the sluice gates would likely be minimized by placement of a coffer dam around the gates to minimize release of sediment. Work along the dam bordering the impoundment would likely be completed from a barge or boat. Downstream repairs would occur by direct access and establishment of a temporary access point in the water. Repairs would be completed under a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to ensure no significant impacts occur to water resources. Any fill would be removed upon completion of the project.

5.2.3.1.3 *Floodplain*

No impacts to the floodplain would be expected to occur as a result of the No Action Alternative.

5.2.3.1.4 *Wetlands*

There would be no permanent proposed fill materials placed in or removed from wetlands as a result of the No Action Alternative. The current water levels and flood regime upstream of the dam would not be altered, allowing the current floodplain wetlands to continue functioning. The No Action Alternative would have temporary direct effects on existing wetland resources in the vicinity of the dam and impoundment while repairs are being carried out. Approximately 0.01 acres of temporary fill would impact wetlands 18 and 19, combined, for creation of the north access road. The temporary fill would be removed approximately within 12 months after completion of all in-stream work at the former dam site. Repairs would be completed under a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to ensure no significant impacts occur to water resources.

5.2.3.1.5 *Water Quality*

The No Action Alternative is not expected to impact existing water quality. A negligible amount of sediment could pass through the sluice gates during their rehabilitation; however, the volume would be small and pass easily in the system to settle out. It is expected that the No Action Alternative would not directly impact water resources from their current conditions.

5.2.3.2 Post-Construction Effects

5.2.3.2.1 *Groundwater*

No impacts to groundwater resources would be expected to occur as a result of the No Action Alternative.

5.2.3.2.2 *Surface Water*

Surface water conditions would return to baseline after rehabilitation of the dam. There would be no impacts to the Scenic River designation.

5.2.3.2.3 *Floodplain*

No impacts would be expected to occur to the existing floodplain.

5.2.3.2.4 *Wetlands*

Temporary impacts to wetlands 18 and 19 would end and the wetlands provided the opportunity to vegetate and revert back to pre-construction state. No other impacts to wetlands would be expected to occur.

5.2.3.2.5 *Water Quality*

Operation of the dam would be similar to current operation conditions with the exception of annually opening the sluice gates to ensure their functionality. There would be no improvements to water quality and the Sandusky River would continue not to meet its designated beneficial use for aquatic life. Further, the impoundment would continue to periodically experience algal blooms. Opening of the sluice gates may result in short discharges of sediment. However, discharges are expected to be negligible. Operation of the dam would be in compliance with ODNR Dam Safety standards and the Clean Water Act and Rivers and Harbors Act. The dam would continue to impact water quality by continuing to be a barrier to natural hydrological processes and sediment transport.

5.2.3.3 Mitigation Measures

5.2.3.3.1 *Groundwater*

No mitigation measures are proposed for groundwater as no impacts either direct or indirect are expected to occur.

5.2.3.3.2 *Surface Waters*

Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects such as soil erosion, resulting from rehabilitation that could contribute to sediment deposition. Work in the Sandusky River would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to ensure no significant impacts occur to surface waters. No compensatory mitigation is expected to be required.

Prior to initiation of the Ballville Dam rehabilitation, the City would develop specific plans for access including the need for a cofferdam. At this time, projected temporary impacts to streams are approximately 250 linear feet and are entirely within channel of the Sandusky River. This would fall within the requirements of the Nationwide permit (NWP) and not require mitigation. All temporary fill to streams would be removed and areas restored to previous conditions.

5.2.3.3.3 *Floodplain*

No mitigation measures are proposed for floodplain as no impacts either direct or indirect are expected to occur.

5.2.3.3.4 *Wetlands*

Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects such as soil erosion, resulting from rehabilitation that could contribute to sediment deposition. Work in the Sandusky River would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act).

Prior to initiation of the Ballville Dam rehabilitation, the City would develop specific plans for access. At this time, projected impacts to wetlands are less than a tenth of an acre and therefore would fall within the requirements of the NWP and not require mitigation. All temporary fill to wetlands would be removed and areas restored to previous conditions

5.2.3.3.5 *Water Quality*

Impacts to the lower Sandusky River and Lake Erie would be minimized through the timing of the rehabilitation. Rehabilitation activities expected to release sediment into the river would be carried out when ambient concentrations are already high to reduce the likelihood of an abrupt environmental change or shock to the lower river; and at the beginning of the wet season, anticipating sufficient flow rate to assist with sediment transport

Best Management Practices (BMPs) and acceptable maintenance procedures would be used to reduce or eliminate anticipated undesirable effects. Additionally, any maintenance in the Sandusky River would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA

(Section 401 Clean Water Act). All terms and conditions would be followed to minimize or avoid impacts to water resources.

5.2.4 Alternative 2 – Rehabilitate Dam, Install Fish Passage Structure

5.2.4.1 Construction Effects

5.2.4.1.1 *Groundwater*

No impacts to groundwater resources would be expected to occur as a result of Alternative 2.

5.2.4.1.2 *Surface Water*

Impacts from dam rehabilitation would be the same as those described in Section 5.2.3.1.2. Alternative 2 would have additional permanent direct effects on existing stream resources from construction of the fish elevator system. The fish elevator system would be built into the north abutment of the dam and would not significantly affect the flow regime of the Sandusky River. The upper tail race that would be constructed to allow safe release of fish upstream of the dam would have a small (<0.1 acre [<0.04 hectare]) footprint into the river and would not be expected to have a significant impact on the river. Rehabilitation to the dam and construction of the fish elevator would be completed under a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to ensure no significant impacts occur to water resources.

5.2.4.1.3 *Floodplain*

No impacts to the floodplain would be expected to occur as a result of the rehabilitation of the dam and construction of the fish elevator. However, the rehabilitation work and installation of fish passage structure would require fill within the floodplain and therefore would require a floodplain permit. Any fill for temporary roads within the floodplain would be removed and the area restored to previous conditions. The terms and conditions stated in the floodplain permit would apply.

5.2.4.1.4 *Wetlands*

Similar to Section 5.2.3.1.4, a temporary access road for dam rehabilitation would be installed and removed. The access road would fill portions of Wetland 18 and 19, totaling 0.01 acres (0.004 hectares) of temporary impacts. This alternative would have additional impacts to wetlands from construction of the fish elevator system. Wetland 17, located upstream of the dam, would be directly impacted as a result of installation of the fish elevator. It is expected that the entire 0.09 acre (0.04 hectare) wetland would be permanently filled during construction of the sorting facility and upstream tail race. There would be no permanent proposed fill materials placed or removed in wetlands downstream of the dam as a result of Alternative 2.

5.2.4.1.5 *Water Quality*

The Fish Passage Structure Alternative is not expected to impact existing water quality. A negligible amount of sediment could pass through the sluice gates during their repair; however, the volume would be small and pass easily in the system to settle out. Additionally, work completed at the north abutment such as the installation of the sort/count facility, lifting system and trap system would be completed during low flows and proper sediment management and construction material management would be in place to prevent discharge downstream. It is expected that this alternative would not directly impact water resources from their current conditions.

5.2.4.2 Post-Construction Effects

5.2.4.2.1 *Groundwater*

No impacts to groundwater resources would be expected to occur as a result of Alternative 2.

5.2.4.2.2 *Surface Water*

Surface water conditions would return to baseline after rehabilitation of the dam and construction of the fish elevator. The Sandusky River would continue not to meet its designated beneficial use for aquatic life, particularly in the impounded area. Although the opportunity for native fish species to pass through the fish passage elevator to spawn in the upstream reaches (approximately 22 miles) would exist, downstream reaches would continue to lack the aggradation of course materials suitable for spawning. In addition to lacking coarse substrate material to replenish spawning habitat, the current deposition of fine materials would continue to fill interstitial spaces adding to the degradation of current spawning areas. There would be no changes to the Sandusky River's Scenic River designation.

5.2.4.2.3 *Floodplain*

No impacts are expected to occur to the existing floodplain.

5.2.4.2.4 *Wetlands*

Wetlands 18 and 19 would re-vegetate and revert back to their pre-construction state. Wetland 17 (0.09 acres) would be filled, but would likely not require compensatory mitigation for this impact. This alternative would be expected to be authorized under the nationwide permit program, these losses would not exceed the general permit condition's threshold (0.1 acres) required for compensatory mitigation (USACE public notice LRG-201100098-5: 2012, p.80). No other impacts to wetlands would be expected to occur.

5.2.4.2.5 *Water Quality*

Operation of the dam would be similar to current operation conditions with the exception of annually opening the sluice gates to ensure their functionality and operation of the fish elevator from March to July. No impacts to water quality are expected as a result of operation. Opening of the sluice gates may result in short discharges of sediment. However, discharges are expected to be negligible. Operation of the dam would be to ODNR Dam Safety standards and in compliance with Clean Water Act and Rivers and Harbors Act.

5.2.4.3 Mitigation Measures

5.2.4.3.1 *Groundwater*

No mitigation measures are proposed for groundwater as no impacts either direct or indirect are expected to occur.

5.2.4.3.2 *Surface Water*

Temporary stream fills would be removed and the stream restored to prior condition. Construction and maintenance of the facility would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to ensure minimal, if any, impacts to water resources.

5.2.4.3.3 *Floodplain*

No mitigation measures are proposed for floodplain as no impacts either direct or indirect are expected to occur.

5.2.4.3.4 *Wetlands*

Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects such as soil erosion, resulting from rehabilitation that could contribute to sediment deposition. Work in the Sandusky River would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act).

Compensatory mitigation would likely not be required. The total impacts to wetlands both temporary (i.e. 0.01 acres for Wetland 18 and 19) and permanent (i.e. 0.9 acres for Wetland 17) would be less than 0.1 acres. This alternative would be expected to be authorized under the nationwide permit program, these losses would not exceed the general permit condition's threshold (0.1 acres) required for compensatory mitigation (USACE public notice LRG-201100098-5: 2012, p.80).

5.2.4.3.5 *Water Quality*

Impacts to the lower Sandusky River and Lake Erie water quality would be minimized through the timing of the rehabilitation and construction. Rehabilitation activities expected to release sediment into the river would be carried out when ambient concentrations are already high to reduce the likelihood of an abrupt environmental change or shock to the lower river; and at the beginning of the wet season, anticipating sufficient flow rate to assist with sediment transport

Best Management Practices (BMPs) and acceptable maintenance procedures would be used to reduce or eliminate anticipated undesirable effects. Additionally, any maintenance in the Sandusky River would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to minimize or avoid impacts to water resources.

5.2.5 Alternative 3 – Dam Removal with Ice Control Structure

5.2.5.1 Construction Effects

The impacts would be the same as those described under Section 5.2.2.1 of the Proposed Action. Alternative 3 is designed to construct the ICS and remove the dam in as short a time period as possible.

5.2.5.1.1 *Groundwater*

The impacts would be the same as those described under Section 5.2.2.1.1.

5.2.5.1.2 *Surface Water*

The impacts would be the same as those described under Section 5.2.2.1.2.

5.2.5.1.3 *Floodplain*

The impacts would be the same as those described under Section 5.2.2.1.3

5.2.5.1.4 *Wetlands*

The impacts would be the same as those described under Section 5.2.2.1.4

5.2.5.1.5 *Water Quality*

As mentioned earlier in the section, the magnitude and duration of water quality impacts resulting from dam removal depend on many factors including:

- the volume and composition of sediments stored upstream of the dam;
- river discharge at the time of the breach and in the months that follow;
- suspended solids and/or turbidity concentrations at the time of the breach;
- channel slope;
- basin area;
- time that has passed since demolition; and
- the distance from the dam location.

Based on other studies of dam removal, if it is assumed that 840,000 CY (all sediment stored) would be exported during dam removal and that sediment would deposit on less than ¼ of the surface area available, then the depth of deposition would be approximately 2/3 of an inch (1.7 centimeters). Loading from dam removal would be small in comparison to loading from the Sandusky River watershed. Between 1979 and 2002, the Sandusky River watershed delivered 8,828,000 CY yards of sediment to the USGS Gauge 0419800 located at Tindall Bridge. Approximately 867,000 CY were delivered by the watershed in a single year and 143,000 CY in a single day (Stantec 2011b). The mean annual load is approximately 368,000 CY, nearly half the estimated volume of material currently stored in the impoundment (840,000 CY). While dam removal would contribute sediment to the river, in most years loads would fall within the natural range of variation for the watershed.

Concentrations of suspended solids are not expected to increase appreciably over concentrations observed routinely in the river (Stantec 2011b). When modeling the impacts of release of the stored sediment it was predicted that in a wet year, high flow concentrations remain in the range of 50 to 500 mg/L (Stantec 2011b). The mean annual daily total suspended solids (TSS) concentration in the period between 1979 and 2002 was 89 mg/L. Observed high flow concentrations in the same period ranged between 109 and 590 mg/L. Seeding exposed stored sediment remaining in the impoundment would also aid in reducing erosion and aid in water quality recovery.

5.2.5.2 Post-Construction Effects

5.2.5.2.1 *Groundwater*

Post-construction impacts to groundwater are not expected to occur as a result of the Alternative 3.

5.2.5.2.2 *Surface Water*

The substrate in free flowing portions of the Sandusky River is composed of limestone bedrock with smaller amounts of boulder, cobble, gravel, and sand substrates (OEPA 2011). The free flowing reaches in the Sandusky River have better habitat conditions than the current impounded areas that support a diverse community of fish and macroinvertebrate species. Completion of the Alternative 3 would allow the opportunity for species to migrate upstream as well as downstream (OEPA 2011a). As time elapses after the dam removal, the coarser substrates upstream of the former impoundment would be transported downstream, improving habitat conditions in the former impoundment and downstream. The former impounded area would be expected to revert to a natural stream channel similar to that above the current impounded area. Width and depths would be similar as sediment erosion from the initial notch and dam removal stabilizes. Biological and habitat index scores would be expected to improve and become more comparable to the current scores both directly upstream and downstream of the impoundment. The impacts to the Scenic River designation would be the same as those described in Section 5.2.2.2.2.

5.2.5.2.3 *Floodplain*

Floodplain elevations would decrease in the areas behind the former Ballville Dam as the impoundment dewaters and reverts back to a riverine flow regime. The impounded area would reduce in size to a width an approximate average width of 175 feet (53.3 meters) wide. The floodplain width would be, in general, consistent through most of the lower Sandusky River until the flood control reach. The ICS are designed to catch ice floes and promote ice damming at their location. This utilizes the area behind the former dam location to store ice sheets so that flooding does not occur downstream as a result of ice damming.

5.2.5.2.4 *Wetlands*

Post-construction effects to wetland would be similar to those presented in the Proposed Action.

5.2.5.2.5 *Water Quality*

As the project would be completed, the Sandusky River connectivity would recover and allow for a natural transport and deposition cycle. This would allow for the riverine habitat to replenish itself and improve its various life use designations. Table 4-4 shows that the IBI, MIwb and ICI indices upstream of the dam are, in general, much lower than those values in areas in full attainment. Removal of the dam would allow the Sandusky River to meet the Aquatic Life Use Attainment values in those areas currently in non-attainment. The new scoring would help maintain the Sandusky River's Warm Water Habitat designation. By removing the dam, impairments such as excessive siltation, low summer dissolved oxygen concentrations, and lentic conditions would be eliminated. This would allow for replacement of opportunistic pollution-tolerant aquatic communities with communities found in healthy aquatic riverine environments. However, because runoff within the watershed is heavily impacted by agricultural practices, removal of the dam would not reduce the potential for nutrient pulses to occur. Events of nitrate elevation would continue to occur with the Sandusky River due to the agricultural influence in the watershed. However, the removal of the dam would provide for these events to flow downstream more quickly without pooling behind a dam. Additionally, because the Sandusky River would be a free flowing river with no impedance, the potential for harmful algal blooms is reduced.

5.2.5.3 Mitigation Measures

5.2.5.3.1 *Groundwater*

No impacts would be expected to occur to groundwater resources. Therefore, no mitigation measures would be proposed for groundwater.

5.2.5.3.2 *Surface Water*

Mitigation measures for surface waters would be the same as those for the Proposed Action.

5.2.5.3.3 *Floodplain*

A letter of map revision (LOMR) would be provided to the Federal Emergency Management Agency (FEMA) to amend their flood mapping resources. Details of that correspondence would be determined in consultation with the local floodplain administrator.

5.2.5.3.4 *Wetlands*

Wetland mitigation would essentially be the same as described for the Proposed Action in Section 5.2.2.3.4. However implementing dam removal during one construction event may allow more sediment to mobilize, resulting in less wetland establishment within the former impoundment. Additional compensatory mitigation may be necessary to offset formation of fewer wetland acres in this alternative.

5.2.5.3.5 *Water Quality*

Mitigation measures for water quality are similar to those for the Proposed Action. Demolition activities expected to release sediment into the river would be carried out at the beginning of the wet season, anticipating sufficient flow rate to assist with sediment transport. The demolition schedule for Alternative 3 has been designed such that sediment releases would occur during cooler months of the year when the metabolic demand of aquatic organisms is low and oxygen saturation in the water would be higher than during summer. This would assist in minimizing respiratory distress that might occur from elevated suspended solids concentrations. Also, many aquatic insects, amphibians, and other organisms would be entering periods of dormancy (e.g., pupation, aestivation, etc.) during the cooler months of the year.

Impacts are minimized by the short-term nature of the planned ICS construction and demolition phase of the dam, as well as the use of BMP's to reduce or eliminate sedimentation during construction.

5.3 WILDLIFE AND FISHERIES

5.3.1 Impact Criteria

Several federal regulations pertaining to fish and wildlife are relevant to this analysis: however, most of those regulations pertain to impacts on rare, threatened, or endangered species and are discussed in Section 5.4. Non-listed migratory birds are also protected under the Migratory Bird Treaty Act (MBTA). This section is focused on migratory birds, interjurisdictional fish, and other aquatic species. This analysis considers:

- Assessment of effects on wildlife and fisheries resources, in legal, commercial, recreational, ecological or scientific terms;
- The proportion of resources that would be affected, relative to its abundance in the region;
- The sensitivity of the resources to proposed activities; and
- The duration of the ecological consequences.

Specifically, effects on wildlife and fisheries resources would be significant if important species or habitats (i.e., species or habitats considered significant by state or federal natural resource agencies) were adversely affected or substantially benefitted over relatively large areas; or if the Proposed Action or alternatives cause substantial reduction or substantial increase in population size or distribution of an important species. The estimated duration of an impact also affects its significance level.

5.3.2 Proposed Action

5.3.2.1 Construction Effects

Demolition of the dam and modification of the seawall would be completed in three phases over a two year period. Phase I would result in construction of an access road to notch the dam. The access road would be developed on current agricultural fields and as such, no impacts to terrestrial species are expected as a result of construction of the access road or its use. The south abutment work pad is approximately 0.5 acre (0.2 hectares) in size with 0.25 acre (0.1 hectares) of scrub/shrub vegetation and few trees. It is from this point the notching of the dam would occur. Work would occur during September 2014. Terrestrial animals that may utilize this habitat, such as birds, are not expected to be impacted as they are mobile and would likely leave the area upon approach of equipment. Bat species are not expected to be roosting in this area at this time as well. Vegetative impacts are not expected to be significant due to the small acreage of clearing and short term use of the work pad.

Notching of the dam would allow concrete to fall into a scour hole directly at the toe of the dam. This could result in some incidental fish mortality; however, the vibration of the hoe-ram notching the dam is expected to cause fish to move away from the location where concrete would fall. Additionally, notching of the dam would result in the export of some sediment currently stored behind the dam (Appendix A11). The magnitude of sediment export would be limited by the relatively small hydraulic capacity of the notch (Riggsbee et al. 2007) and may not differ substantially from the existing condition. The discharge of sediment during phase I (notching of the dam) is not expected to impact aquatic habitats downstream as the concentration of sediment estimated to be brought into suspension would not exceed normal conditions for the lower Sandusky River during high water events. While aquatic insects and mussels are mobile to some extent, and given time may migrate from some of the unsuitable areas, benthic organisms present in the impoundment are expected to be adversely affected by lowering the pool. Aquatic insect assemblages below the water line would recover quickly as a result of the upstream supply of drifting animals. They would soon consist of organisms that utilize riverine habitats rather than lentic assemblages currently present. Previous studies on the effects of dam removals on macroinvertebrate communities suggest that macroinvertebrate assemblages downstream of a dam can experience a reduction in abundance after the impounded sediment is released (Crosa et al. 2010); however, communities have been known to recover in a relatively short amount of time (three months to two years [Crosa et al. 2010; Maloney et al. 2008]). Additionally, a lotic assemblage of macroinvertebrates can replace a lentic assemblage in former impoundments within one to two years after dam removal (Stanley et al. 2002; Maloney et al. 2008).

Aquatic benthic organisms would no longer be able to use the exposed shore line flats and these areas would begin transitioning to riparian forests. Impacts to freshwater mussels would be minimized by capturing and relocating stranded freshwater mussels to locations outside of the drawdown area. Relocation of mussels would be consistent with agency approved study plans.

After Phase I, approximately 20 acres (8.1 hectares) of newly exposed sediment previously inundated by the impoundment would be exposed during the drawdown. Stabilization measures may include aggressive seeding and vegetation strategies to supplement the existing seed banks within the sediment to establish a hearty vegetative cover over exposed areas susceptible to erosion, consistent with the Planting Plan (Appendix A6). Invasive species controls (i.e. chemical treatment, mechanical removal) would be developed prior to seeding as needed to minimize colonization of invasive vegetation. The exposure of the sediment may have a short term beneficial impact to terrestrial species as it catches and exposes seeds, invertebrates, and provides open spaces lacking cover for ambush type predators such as fox, and snakes. This habitat would not have been previously available prior to impoundment drawdown and represents an increase in available terrestrial habitat. It is expected that vegetation would be established prior to removing the remainder of the dam to minimize sediment mobilization.

A second access road from the north side of the river would be developed to continue demolition of the structure. This would provide access from both the American Electric Power storage yard adjacent to the dam and from County Road 501. Impacts to fish and wildlife would be similar to those described above for construction of the south access road during Phase I.

A cycle of knickpoint migration, incision, and widening would likely occur as part of the demolition resulting in the export of a pulse of sediment to downstream of the dam. This cycle would occur repeatedly until a new stable bed elevation is achieved along the length of the impoundment. Subsequent pulses would be mobilized during storm generated high flow events. The impoundment would no longer constrain the physical forces necessary to mobilize and transport coarse-grained substrates. Fish and freshwater mussels would likely be exposed to increased suspended sediment concentrations. Because of the emphasis on sediment control measures proposed for the Ballville Dam Project, it is anticipated that effects to downstream mussel populations, if any, would be short-term. Any adverse impacts would be offset by restored riverine habitat, elimination of a migratory barrier for fish (host) movement, and increased genetic exchange between isolated upstream and downstream populations. Further, both phases of demolition would be scheduled for the fall when stream temperatures are low and metabolic demand by mussels would also be low (Myers-Kinzie 1998) thereby minimizing the potential for physiological stress and mortality. Prior studies of suspended sediment concentrations and dam removals indicate that concentrations may initially be high during the breaching of the dam but that concentrations quickly decline to approach background concentrations. Other periods of elevated concentrations occur associated with storm events and high flows. Thus impacts to water quality would consist of a series of punctuated periods of elevated concentrations that may occur over a period of one to three years (Sethi 2004, Riggsbee et al. 2007, and Major et al. 2012). Fish communities evolved to tolerate increased concentrations for short periods. Since anticipated concentrations from releases would be within the range of natural variability, any adverse effects of increased suspended sediments are expected to be temporary and short-term.

The north access to the downstream side of the dam would provide access to construct the ICS. Current design of the ICS includes a total of 15 piers spaced 21 feet (6.4 meters) apart (on center). Overall, the piers would be 25 feet (7.6 meters) tall and six feet (1.8 meters) in diameter. Negative impacts to terrestrial species are not expected to occur. It is possible that the piers would be used as hunting perches for birds such as the bald eagle and additionally as nesting platforms for osprey.

Construction of the ICS would temporarily exclude aquatic species and limit habitat. Due to the mobility of fish no direct impacts resulting in death are expected. Additionally, ICS construction activities would occur during periods when resident and migratory fish densities are low for this part of the Sandusky River. Displacement of fish would be temporary and fish are expected to quickly recolonize the area. Some fish would likely benefit from the structural habitat provided by the ICS, as the bedrock reach immediately below the dam is often uniform and featureless. Construction activities and the associated noise may cause some temporary displacement of fish. However, fish may acclimate to the noise over time and may re-occupy habitats in the demolition area. Noise and demolition impacts would be limited to a discrete area and adverse effects would be mitigated by the beneficial elements of the project such as increased fish passage. The exposed bedrock in the area immediately below the dam provides very poor habitat and no live mussels were found during 2011 surveys. Consequently mussels should not be adversely affected by ICS construction activities. Construction would include drilling shafts and pouring concrete by tremie method. This is proposed to occur during low flow times of the year (July –October 2015).

Impacts are not expected to occur for terrestrial species during demolition of the dam Installation of the ramp and demolition of the dam are continuing actions that have the potential to impact aquatic species. However, most species are likely to have vacated the project area thus impacts are likely minimal.

Completing Phase II would be the channel grading of the Sandusky River. Expected to occur between November and December 2015, this action would reshape the channel and establish a floodplain on the north side of the river. This would result in short-term increases in suspended sediment concentrations for the duration of the channel work. This may trigger avoidance behaviors by some fish species; however, concentrations are not expected to exceed those generated by storm events. Stabilization measures would be used to prevent erosion and minimize invasive colonization. The grade of the river would be restored to a condition that would allow for migratory aquatic species to access nearly 20 miles (32.2 kilometers) of new habitat. Terrestrial species would then be able to utilize the banks and access the water without construction equipment impeding them.

No impacts to terrestrial or aquatic animals are expected to occur from modification of the seawall and seeding of the riverbank (Phase 3).

5.3.2.2 Post-Construction Effects

It is expected that the removal of the dam and installation of the ICS would not adversely impact terrestrial wildlife in the project area. Beneficial impacts associated with the Proposed Action are likely to result in the presence of increased numbers of forage fish, as represented by adult and juvenile migratory species upstream from the dam, and increased riparian zone connectivity that may increase the mobility of some terrestrial and amphibian species (e.g. turtles). Changes to the fish population would likely benefit wildlife such as river otter, bald eagle, osprey, and kingfisher by providing a larger and more diverse forage base. Ponded open water habitat for waterfowl that exists behind the dam would be eliminated once the dam is removed. Waterfowl would be unlikely to congregate in this portion of the Sandusky River during migration after dam removal, but they would be very likely to congregate at the new off channel reservoir located very near the former impoundment area. Use of the river by opportunistic animals such as beaver, deer, and raccoon is not expected to change. Upstream from the Ballville Dam, the drawdown resulting from dam removal could have short-term benefits to shorebird species by providing larger areas of exposed impoundment substrates for feeding; however, these benefits would not likely persist for long as the exposed shoreline areas would become vegetated with native riparian plant species.

Fish may be temporarily adversely affected by increased sediment loads and the subsequent physiological stress from high suspended sediment concentrations, feeding impairment, reproductive impairment, and changes to structural habitat quality (Appendix A11). However, these impacts appear to be temporary and recovery is generally underway or complete within three to five years (Doyle et al. 2005).

The greatest benefit of dam removal and installation of the ICS would be realized by aquatic species and particularly migratory fish. A diverse fish community of 88 native species has used the river and bay system for some or all of their life stages, including Walleye, White Bass, Channel Catfish, Smallmouth Bass, Redhorse Suckers, Buffalo, and Northern Pike (Bogue 2000). Removal of the dam and installation of the ICS is expected to increase their numbers by promoting more access to spawning habitat upstream of where the dam previously was located.

Walleye and White Bass support important spring river fisheries in the Sandusky River. Although current migratory Walleye and White Bass stocks that reproduce in the Sandusky River support a smaller percentage of the overall fishery in Lake Erie, the removal of the dam is expected to significantly expand the available spawning habitat leading to the potential for increased abundance overtime. An additional 22 miles (35.4 kilometers) of the Sandusky River would be opened to migratory fish species including Walleye, White Bass, and the State-threatened Greater Redhorse. Riverine Walleye populations in the Sandusky system are currently constrained by access to approximately 20 acres (8.1 hectares) of spawning habitat. Access to the upper river would increase available spawning habitat to approximately 300 acres (121.4 hectares).

Jones et al. (2003) suggests that the removal of Ballville Dam along the Sandusky River would help improve the Lake Erie Walleye population by reconnecting 22 miles (35.4 kilometers) of free-flowing river to Lake Erie and providing Walleye access to new spawning habitat. An estimated 25 acres (10.1 hectares) of spawning habitat is available in the reach above the dam that could produce between 10,000,000 and 149,000,000 larval fish on an annual basis. This yield would be on average eight times greater than the Walleye yield in the habitats below the dam (Jones et al. 2003).

Other native species are expected to benefit from dam removal and increase their abundance as well. For example, increased connectivity between critical habitats for Sauger (*Sander canadense*) resulting from removal of Ballville Dam may make it possible to re-establish this species in the basin. The Freshwater Drum, an important host species for freshwater mussels, was collected downstream but not upstream of the dam in a previous study which may indicate improved habitat access for them as well (OEPA 2011a). An improved river flow regime with open access to substantially more habitat as a result of dam removal should provide benefits to virtually all native aquatic species, as well as improving biodiversity when compared to present conditions both above and below Ballville Dam.

The Proposed Action would cause short-term, temporary increases in sediment load downstream of the current dam location. Potential effects to freshwater mussels include physiological stress from elevated suspended sediment concentrations and habitat changes resulting from increased sediment load. Elevated suspended sediment concentrations could interfere with mussel feeding; however, mussels have physiological adaptations that allow them to endure short term environmental stressors (Sheldon and Walker 1989, Haag 2012) such as those expected for the proposed action. Some burial and subsequent mortality of freshwater mussels in the low gradient reaches of the Sandusky River below the dam is probable, especially in areas susceptible to sediment aggradation. However, field and laboratory studies demonstrate that mussels can endure substantial deposition and in some cases levels that are greater than anticipated for the Proposed Action.

It is expected that removal of the dam would benefit mussel habitat in the areas upstream of the dam and downstream. Coarser sediments (cobble, gravel, and sand) would replace the silt dominated substrate in many sections of the impoundment although much of the substrate of the pooled area is expected to convert to bedrock. Some mussel habitat may be created on the margins of the channel but the primary benefit to mussels is the movement of host fish. The proposed action would eliminate a migratory barrier for fish and increase genetic exchange between isolated upstream and downstream mussel populations (Watters 1995).

The ICS would not act as a barrier to fish during spawning periods. The ICS was modeled using the Hydrologic Engineering Centers River Analysis System (HEC-RAS) to help determine if the piers themselves would cause elevated flow and thereby act as a velocity barrier. The model took into account that Walleye burst swimming speed ranges between 5.25 and 8.5 feet (1.6 and 2.6 meters) per second (Peake et al. 2000). At velocities between 500 and 2,500 cfs it was modeled that between 33 and 42 percent of contiguous block flows (i.e. flows between neighboring piers) are less than 5.25 feet / second (1.6 meters / second) thus allowing for Walleye to move past the ICS during migration.

Although the Proposed Action does provide fish passage opportunities for many native species it also removes a barrier to potential invasions by non-native aquatic nuisance species. With possibly numerous new invasive species entering the Great Lakes each year, it is difficult to predict, with any certainty, which would be the next to colonize successfully and which would fail to materialize in the vicinity of Ballville Dam. However, known species such as sea lamprey and Asian Carp are two high profile species of interest relating to the proposed action.

To investigate possible impacts of sea lamprey we consulted with the Sea Lamprey Control Program within the Service. According to their study and expert analysis, “While there is lamprey spawning and larval habitat present up and downstream of the dam, we have never found any larval sea lampreys or native lampreys up or downstream of the dam. The lower portion of the river is a large estuary with low flow which may deter entrance into the river. Overall, there was not enough evidence to suggest that sea lampreys would become a problem in the river."

Asian Carp populations are known to be moving toward the Great Lakes ecosystem from the Mississippi River Basin. Much is unknown regarding Asian Carp and their current status in the vicinity of Ballville Dam; however, three live bighead carp were captured in the western basin of Lake Erie between 1995 and 2000. Environmental DNA is one tool used to sample the environment and can help managers determine the presence of species specific DNA in the water. However, there are many possible eDNA vectors, in addition to live individuals, which could explain its presence including bird feces, boats or equipment used in multiple water bodies, contaminated sewage outputs, etc.(United States 2013, USACE 2013). Positive eDNA samples from 2011-2013 further raise awareness regarding this species and the possible risk of impacts relating to the proposed action. As described in Section 3.4.2.2 a risk analysis was completed to quantify this potential impact.

Based on the risk analysis, experts agreed that the proposed action would not provide increased Risk Potential of Asian Carp to Lake Erie (Appendix E). However, there was mixed Expert characterization of Asian Carp Risk Potential to the Sandusky River under the Proposed Action: two of the Experts projected an increase in Risk Potential, whereas four of the experts projected no change in Risk Potential. It is also worth noting that the uncertainty levels varied amongst the six Expert panelists on this issue, but was consistent between the proposed action and the No Action Alternative. The complete results of this analysis can be viewed in the Risk Analysis Report (Appendix E).

In summary, the proposed action would have a long-term beneficial effect on aquatic species by opening up 22 miles (35.4 kilometers) of Sandusky River habitat that was previously inaccessible due to the presence of the dam. Short-term, minor adverse effects to some localized aquatic species may occur due to sedimentation, but these effects would be minimized by mitigation measures, and would not persist for longer than a few years. The proposed action would provide an additional vector for the movement of aquatic invasive species in the Sandusky River, although it is impossible to know with certainty which species may attempt to utilize this vector or their rate of successful establishment. We have discussed two known species of concern and their relative risk potential.

5.3.2.3 Mitigation Measures

The design for the proposed action employs the use of a notch with is intended to diminish the initial delivery of sediment to downstream reaches. The Proposed Action is an overall 26 month long project with the actual demolition of the Ballville Dam occurring in phases over a 14 month period. Construction would be timed to avoid sensitive life history windows for key species in the project area (e.g., fish reproduction, bat roosting, etc.). This approach was designed to result in the release of smaller volumes of sediment over a longer time frame (not one event).

This is expected to minimize the size of the sediment wedge and the magnitude of suspended sediment associated with any given storm event (Riggsbee et al. 2007). This would also minimize potential impacts to aquatic species inhabiting areas downstream of the dam.

Demolition for the Proposed Action would be sequenced to occur in the fall, just before the onset of the wet season. The timing of construction is important because it would avoid sediment releases during the low flow, warmer summer months when water quality impacts would be the greatest and when the river has the least capacity to move sediment. This strategy would minimize the potential for physiological stress and mortality in aquatic organisms by restricting demolition to periods when stream temperatures would be low and metabolic demand would also be low.

Existing roads would be used to the maximum extent practicable. Any improvements that require tree cutting would adhere to seasonal restrictions (between October 1 and April 1) whenever possible to ensure that direct impacts to bats and breeding birds are avoided. However, development of the south workpad would require clearing of 0.25 acres (0.1 hectares) prior to October 1. An assessment of the habitat and possible survey (i.e. emergence counts) and felling of trees over 7 inches (17.8 centimeters) dbh immediately after survey may be required to ensure no harm to wildlife occurs.

For aquatic species, while continual demolition of the dam occurs and the drawdown of the impoundment continues, native live mussels located on the exposed ban/margins of the former impoundment would be recovered and relocated to suitable habitat in the Sandusky River upstream of the dam as quickly as possible. This activity would be coordinated with ODNR and the Service to ensure appropriate level of effort and effectiveness. Relocated mussels would be periodically monitored to determine survival rates, and a monitoring report would be provided to ODNR and the Service.

A pre- and post-project monitoring plan is in place for aquatic populations utilizing the lower Sandusky river relating to the Proposed Alternative. Pre-project monitoring characterizing the current fish community in the area around the Ballville Dam, and to quantify migratory fish abundance has been completed (OEPA 2011a; Ross 2013). Fish assessment surveys will be completed periodically into the future to quantify potential responses in the fish community.

Colonization of upstream reaches by aquatic invasive species may take years or decades, post project aquatic resource monitoring would assist in understanding what species are moving through the area and utilizing the aquatic habitat. In the event aquatic invasive species are detected, there are numerous aquatic resource management tools that could be utilized dependent on the species and their extent. For example, the Asian carp Risk Analysis Expert panel provided some ideas for practical, effective, and efficient management to control abundance and mitigate impacts of Asian carps in the Sandusky River, if they establish self-sustaining populations there. The most frequent recommendation was targeted harvest (recruitment overfishing), however the full list of ideas provided can be viewed in the Risk Analysis Report (Appendix E). Additionally, ODNR has developed an Asian Carp Tactical Plan that identifies strategies to minimize the risks of introduction of Asian carp into the Lake Erie basin, as well as explicit response plans for detection of Asian carp in Ohio waters (ODNR 2013b). Ultimately, it would be the responsibility of aquatic resource managers to monitor aquatic species to assess their status and carry out management actions as necessary.

Lastly, Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects such as soil erosion, resulting from construction that could contribute to sediment deposition. The Proposed Action would re-seed approximately 20 acres (8.1 hectares) of exposed sediment upstream of the dam with the intent to stabilize as much sediment in place as possible. Erosion control and stormwater management is required during construction through the National Pollutant Discharge Elimination System (NPDES) permitting program. Additionally, any work in the Sandusky River would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to ensure no significant impacts occur to wildlife and fisheries.

5.3.3 Alternative 1 – No Action Alternative

5.3.3.1 Construction Effects

The exact methods for construction are not known at this time, however, it is anticipated that some form of containment cell would be necessary upstream of the dam to dewater areas adjacent to the sluice gates. Construction associated with the containment cells could result in temporary displacement of fish and wildlife. However, thick, anoxic sediment deposits exist immediately upstream of the dam. These conditions likely cause avoidance by fish and would therefore minimize the potential for adverse impacts to fish. Work associated with the concrete repairs would also cause temporary displacement for fish and wildlife.

5.3.3.2 Post-Construction Effects

Operation of the dam would be similar to current operation conditions with the exception of annually opening the sluice gates to ensure their operation. Opening of the sluice gates may result in short discharges of sediment. Fish kills have been documented as a result of operation of sluice gates (e.g., Hesse and Newcomb 1982); however, proper management of the timing and duration of releases can minimize adverse impacts to aquatic species. It is anticipated that the sluice gates would only be opened for a sufficient duration to ensure that they would be operable. Thus, the load of sediment discharged in this time period would be negligible. The dam would continue to be a barrier to aquatic species migration and natural hydrologic and sediment transport processes in the Sandusky River.

5.3.3.3 Mitigation Measures

Rehabilitation would be completed under a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to ensure no significant impacts occur to wildlife and fisheries resources.

Sluice gates would only be opened for the minimal time necessary to demonstrate functionality. Additional gate openings could also be conducted to maintain operability. These additional openings would minimize any impacts to aquatic resources by occurring in colder weather when dissolved oxygen is highest in the water.

Operation of the dam would be to ODNR Dam Safety standards and in compliance with Clean Water Act and Rivers and Harbors Act.

5.3.4 Alternative 2 – Rehabilitate Dam, Install Fish Passage Structure

5.3.4.1 Construction Effects

Construction impacts associated with repair of the dam are the same as those described in Section 5.3.3.1. In addition, construction of the fish ladder and sorting building would also likely result in short term impacts to water quality and temporary displacement of fish and terrestrial wildlife. Impacts would result from the pouring of concrete, modification of the stream bed topography near the fishpass inlet (if necessary), and operation of heavy equipment in and near the channel. The sorting facility would be constructed in a previously disturbed area without wetlands or terrestrial vegetation and impacts are not expected. Some temporary displacement of birds and other types of urban wildlife may be expected during construction.

5.3.4.2 Post-Construction Effects

Post construction impacts associated with the rehabilitation of the dam are the same as those described in Section 5.3.3.2. In addition, it is anticipated that this operation of a fish elevator system on Ballville Dam, with the inclusion of a fish sorting facility to withhold invasive species, would have negligible adverse impacts (e.g., stress from handling, exposure to infectious diseases from crowding) to fisheries. However, positive impacts of this alternative on native species populations such as Walleye, White Bass, River Redhorse, Greater Redhorse, and Freshwater Drum may depend on the behavioral characteristics and the physiology of each fish species. We could find no published examples of fish elevators for a dam of equal size to Ballville with a similar complement of species. At present it is uncertain how effective the fish elevator would be. While a fish elevator would provide increased access for some species, it is expected that this alternative would have limited benefit to fish migration in the Sandusky River because not all species can or would use an elevator. Fish community integrity would continue to be low in the impounded section due to degraded habitat, altered hydraulics, poor water quality, and reduced aquatic invertebrate production.

Fish elevator systems are not used for downstream fish passage, meaning that individuals moving downstream would either be stopped by Ballville Dam or pass over the spillway, increasing the likelihood of mortality. For migratory species, such as Walleye or White Bass, which successfully navigate the elevator system and reproduce upstream of the dam, it is expected that larval mortality would be high but it is not possible to quantify how high at this time. Causes of mortality would include physical trauma from hydraulic forces as well as blunt force impacts (e.g., rocks, concrete, etc.). Small fish passing over the dam would likely be disoriented and subject to predation from fish holding below the dam. It is known that adult

Walleye planted in the upper watershed passed successfully over the dam and were recaptured in the lower river (Jeff Tyson personal communication).

5.3.4.3 Mitigation Measures

Construction and maintenance of the facility would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to ensure minimal, if any, impacts to wildlife and fisheries.

Construction would be timed to avoid sensitive life history windows for key species in the project area (e.g., fish reproduction, bat roosting, etc.).

Sorting facilities would be operated in the migration period to prevent non-native aquatic species from passing upstream.

Maintenance operations would be completed during non-spawning seasons (mid-June to March). Maintenance is not expected to impact wildlife or fisheries.

5.3.5 Alternative 3 – Dam Removal with Ice Control Structure

5.3.5.1 Construction Effects

Alterations to the structural and functional elements of aquatic and terrestrial ecosystems from construction associated with Alternative 3 would be similar to those described in Section 5.3.2.1. Alternative 3, however, is designed to construct the ICS and remove the dam in as short a time period as possible. Therefore, this alternative has the potential to impact aquatic species and habitat more severely than in the Proposed Action. In the Proposed Action, suspended solids would be elevated during construction of the causeway, the ICS, and during breaching of the dam. Concentrations would increase again when construction is resumed the following year. Under Alternative 3, elevated concentrations would be continuous for the duration of construction. While suspended sediment concentrations during construction are not expected to exceed concentrations observed during storm generated events. Alternative 3 would result in prolonged minor adverse impacts (e.g., disrupted foraging) to sediment intolerant species. Some turbidity tolerant species such as Yellow Perch may realize a temporary competitive advantage over other species (Clayton and Morris 2009). Other visual sight feeders (e.g., kingfishers, blue herons) may also be temporarily affected.

Tree clearing for the north access road would occur between October 1 and March 31 to avoid impacts to bats and breeding birds. Clearing of approximately 0.3 acres (0.1 hectares) of trees would be necessary for developing an access road for completing the project and maintaining the ICS.

The discharge of sediment, as a result of a single phase dam removal, into the downstream reach of the Sandusky River has the potential to increase sediment concentrations and impact aquatic habitat. In Alternative 3 all of the sediment upstream of the impoundment would be available for export immediately after demolition of the dam. This could lead to greater aggradation in the downstream reaches and shifts in substrate type to finer grained sediment. In most cases effects to aquatic organisms are within the natural range of variation for aquatic organisms in the Project Area (Appendix A11). However, Alternative 3 would likely increase the severity of disturbances to aquatic communities in comparison to the Proposed Action.

5.3.5.2 Post-Construction Effects

Adverse and beneficial effects associated with Alternative 3 would be very similar to those described in Section 5.3.2.2. However, the magnitude of adverse effects on downstream aquatic biota associated with Alternative 3 would likely be greater due to the less controlled nature of the sediment release. It is expected that the duration of sediment export from the impoundment would be shorter in this scenario than in the Proposed Action. Therefore higher suspended sediment concentrations and more sediment aggradation would be expected in the downstream channel. Short term changes to habitat resulting from the sediment wedge would potentially degrade spawning habitat and reduce foraging efficiency for fish. Increased suspended sediment concentrations may cause physiological stress and alter some behaviors; however, concentrations are expected to fall well short of lethal levels. The primary difference between the Proposed Action and Alternative 3 is that, given equal stream flow patterns, the magnitude of sediment export in Alternative 3 would be higher. The notch in the Proposed Action is intended to minimize adverse impacts of this export to fish and other aquatic organisms although the benefits of this strategy are difficulty to quantify given the inherent variability of natural systems (i.e., stream flow patterns). One beneficial aspect of Alternative 3 is that it would provide fish passage one year earlier than the Proposed Action.

5.3.5.3 Mitigation Measures

Existing roads would be used to the maximum extent practicable. Construction would be timed to avoid sensitive life history windows for key species in the project area (e.g., fish reproduction, bat roosting, etc.). Development of the north access road for access to the area below the dam would adhere to seasonal restrictions for tree clearing (October 1 to March 31) to avoid impacts to bats and birds either migrating or breeding. Additionally, these dates are the most likely to avoid impacts to other wildlife that could be present during other times of year.

For aquatic species, while continual notching of the dam occurs and the drawdown of the impoundment begins, native live mussels located on the exposed bars/margins of the former impoundment would be recovered and relocated to suitable habitat in the Sandusky River upstream of the dam as quickly as possible. This activity would be coordinated with resource agencies. Relocated mussels would be periodically monitored to determine survival rates, and a monitoring report would be provided to ODNR and the Service.

A pre- and post-project monitoring plan is in place for aquatic populations utilizing the lower Sandusky river relating to Alternative 3. Pre-project monitoring characterizing the current fish community in the area around the Ballville Dam, and to quantify migratory fish abundance has been completed (OEPA 2011a; Ross 2013). Fish assessment surveys will be completed periodically into the future to quantify potential responses in the fish community. Demolition for Alternative 3 would be sequenced to occur in the fall, just before the onset of the wet season. The timing of construction is important because it would avoid sediment releases during the low flow, warmer summer months when water quality impacts would be the greatest and when the river has the least capacity to move sediment. This strategy would minimize the potential for physiological stress and mortality in aquatic organisms by restricting demolition to periods when stream temperatures would be low and metabolic demand would also be low.

Lastly, Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects such as soil erosion, resulting from construction that could contribute to sediment deposition. Erosion control and stormwater management is required during construction through the National Pollutant Discharge Elimination System (NPDES) permitting program. Additionally, any work in the Sandusky River would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to ensure no significant impacts occur to wildlife and fisheries.

5.4 RARE, THREATENED, AND ENDANGERED SPECIES

5.4.1 Impact Criteria

Plant and animal species that are federally- and/or state-listed as threatened, endangered, or other listing status pursuant to the Endangered Species Act (ESA) and/or the Ohio Revised Code (ORC) Chapter 1518.01-99, 1531.25, and 1531.99 are protected from unauthorized take, which includes actions such as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect (Chapter 1). The ESA requires that federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of designated critical habitat.

Section 7 of the ESA directs Federal agencies to consult with the Service if their proposed action “may affect” a listed species. If, due to implementation of avoidance and minimization measures, the action agency determines, and the Service concurs that the project “may affect, but is not likely to adversely affect” listed species, consultation can be concluded informally. If, despite implementing avoidance and minimization measures, the project “may affect, and is likely to adversely affect” listed species, formal consultation is necessary.

The formal consultation process describes the types of effects and quantifies the amount of take that is likely. The Service analyzes the impact of the taking in a Biological Opinion, and, so long as the action is not likely to jeopardize the continued existence of the listed species, or to destroy or adversely modify designated critical habitat, the Service can issue an incidental take statement, authorizing a limited amount of take. The following types of direct and indirect effects[4] were considered in evaluating the impact of the Proposed Action and alternatives on threatened and endangered species:

- Direct effects to federally- or state-listed species including the taking (removal or loss) of an individual or population; or a change in an individual or population's habitat use due to Project implementation;

- Indirect effects to federally or state-listed species such as increased competition for resources or habitat due to displacement of individuals from the affected area into the territory of other animals, habitat destruction, or other indirect effects which cause mortality, decreased fitness, or reduced breeding and recruitment in the future population; and

- Direct or indirect effects on habitat types that affect population size and long-term viability for federally and state-listed species.

Specifically, impacts to threatened and endangered species were considered significant if federally- or state-listed species or their habitats would be adversely affected over relatively large areas: or if disturbances related to the Proposed Action or alternatives would cause significant reductions in population size or distribution of a listed species. The duration of an impact also affected its significance level: temporary impacts (e.g., noise associated with construction) were considered less significant than permanent impacts (e.g., land conversion).

As described in Chapter 4, the following federally-listed species, though listed within Sandusky County, are not present in the project area, and therefore the Proposed Action or any of the alternatives would have no effect on them: piping plover, rayed bean, eastern prairie-fringed orchid, Rufa red knot, and eastern massasauga. Therefore these species will not be addressed further in this document.

5.4.2 Proposed Action

5.4.2.1 Construction Effects

The Proposed Action has the potential to affect state and federally listed species. These potential impacts are discussed further below.

5.4.2.1.1 *Federally Threatened, Endangered, and Candidate Species, and Species of Concern*

Indiana Bat. Approximately 0.5 acres (0.2 hectares) of wooded shoreline would be removed to allow for a south work pad and north access road. Clearing of 0.25 acres (0.1 hectares) of woods for the north access road would only occur after October 1 and before April 1, when Indiana bats would be hibernating and not using forested habitat. This would avoid direct effects to Indiana bats from this portion of the action.

[4] "indirect effects" are "those effects that are caused by or will result from the Proposed Action and are later in time, but are still reasonably certain to occur" (50 CFR§402.02).

Due to project schedule, clearing of 0.25 acres for the south workpad is expected to occur in September. During this time, Indiana bats could be migrating through the project area and using areas of suitable wooded habitat for roosting and/or foraging. In order to avoid direct effects to Indiana bats from removal of 0.25 acres of forest habitat during the migration period, the following actions would be taken: (1) a habitat assessment of the 0.25 acre area of tree clearing would be completed to identify any potential roost trees and assess the quality of the habitat for foraging; (2) if potential roost tree(s) exist, an emergence survey would be conducted, following Service protocol, to determine if bats are using the tree(s) for roosting; (3) if no bats are detected emerging from the tree(s), the tree(s) would be cut the day following the second night of survey; (4) if a bat(s) is detected emerging from the tree the tree would not be cut. Emergence surveys would be repeated until two consecutive nights without any bat emergence are documented. Then the tree(s) would be cut the day following the second night of survey. This would avoid direct effects to Indiana bats from removal of roost trees.

Although Indiana bats are known to exhibit site fidelity to individual roost trees, they are also known to frequently shift from one roost tree to another in their home range. Roost trees are an ephemeral resource, as weathering, decay, and insect activity eventually makes roost trees less suitable over time (e.g., exfoliating bark eventually falls off or the snag falls over). It is likely that due to the ephemeral nature of roost trees, the Indiana bat has evolved to be able to locate replacement roosts when their previously-used roost trees become unsuitable.

Because the Sandusky River corridor in the project area supports approximately 110 acres (44.5 hectares) of forest cover, loss of any suitable roost trees within the 0.5 acre of forest to be cleared would result in only insignificant and discountable indirect effects to Indiana bats that may use the project area for roosting. Sufficient suitable roosting habitat would remain within and adjacent to the project area, and the overall suitability of habitat within the project area for Indiana bats would remain unchanged.

Forest removal could result in adverse indirect effects to Indiana bats by reducing the amount of available foraging habitat, and increasing energetic costs for finding alternative foraging habitat. However, because impacts to foraging habitat total only 0.5 acres, and approximately 130 acres (52.6 hectares) of deciduous forest, woody wetlands, and emergent herbaceous wetland habitat is available, the adjustments in Indiana bat foraging ranges are not expected to result in physiological responses sufficient to cause death or injury, or to impair reproduction. Therefore, any indirect effects are likely to be insignificant. Removal of 0.25 acres of potential foraging habitat during the fall migratory period would be extremely unlikely to result in direct effects to individual migrating Indiana bats, as sufficient foraging habitat is immediately available adjacent to the area to be cleared.

Aquatic resources are valuable foraging habitats for Indiana bats because there is high insect abundance associated with these resources, as well as drinking water. In addition, riparian corridors associated with aquatic resources are valuable movement corridors for Indiana bats, particularly when they are forested and when they provide connectivity to other forest areas.

Indiana bats prey on insects, and are opportunistic in selecting prey, but they are known to forage over stream corridors for aquatic insects. The Proposed Action would cause short-term, temporary increases in sediment load downstream of the current dam location. This would result in short-term declines in aquatic insect populations in adjacent wetlands and waterways, and corresponding localized prey reduction and water quality reduction. Foraging Indiana bats would likely temporarily relocate upstream or downstream of impacted areas to forage. Because of the emphasis on sediment control measures proposed for the Ballville Dam Project, it is anticipated that effects to downstream aquatic insect populations would be short-term. Further, both phases of demolition and hence, the timeframes when the largest quantity of sediment would be released and when aquatic insect populations would be most affected, would be scheduled for the fall when Indiana bats are beginning to hibernate and would not be expected within the project area. Furthermore, the diet of Indiana bats is not restricted to aquatic insects, since they also forage on terrestrial insects, and the surrounding landscape would continue to provide an abundant prey base of both terrestrial and aquatic insects during project construction. Therefore, any potential effects on Indiana bats from localized reductions in water quality are anticipated to be insignificant.

In summary, due to the proposed avoidance and minimization measures the construction phase of the Proposed Action is not likely to adversely affect Indiana bats.

<u>Northern long-eared Bat</u>. Construction impacts to the northern long-eared bat would be similar to the Indiana bat. Species proposed for listing are not afforded protection under the ESA; however as soon as a listing becomes effective, the prohibition against jeopardizing its continued existence and “take” applies regardless of an action’s stage of completion. Therefore any adverse effects to Northern long-eared bats that might occur due to clearing of 0.25 acres of trees prior to listing are not prohibited, though other avoidance and minimization measures have been proposed to minimize potential effects to this species both prior to listing, and if a decision is made to list the species.

Clearing of trees between October 1, 2014 and March 31, 2015 falls within the time frame when Northern long-eared bats would be hibernating and not using forested summer habitat. Therefore tree clearing between October 1 and March 31 is not likely to adversely affect Northern long-eared bats. If the species is listed and tree clearing is to occur between April 1 and September 30, 2015, surveys to detect the presence or likely absence of the species within the areas to be cleared would be implemented. If Northern long-eared bats are detected during the surveys and take of the species cannot be avoided, then formal consultation under Section 7 of the Endangered Species Act would be implemented.

Indirect effects from habitat loss and degradation during the construction phase of the project are expected to be insignificant.

<u>Kirtland’s Warbler</u>. The Project Area lies within the migratory range of the federally endangered Kirtland’s warbler. Suitable migration stopover habitat exists adjacent to the river and includes forest and shrub/scrub habitat. Kirtland’s warblers are transient during migratory seasons throughout Ohio (ODNR 2011a) and no records for these species are known from within the Project Area. Approximately 0.5 acres of wooded shoreline would be removed to allow for a

south work pad and north access road. Clearing of 0.25 acres of woods for the north access road would not occur during periods of time when the Kirtland's warbler migrates (April 22 – June 1, and from August 15 – October 15). This would avoid direct effects to Kirtland's warblers from this portion of the action.

Due to project schedule, clearing of 0.25 acres for the south workpad is expected to occur in September when Kirtland's warblers migrate through Ohio. The habitat within the area to be cleared is stream edge shrub/wooded area. Kirtland's warblers migrate individually. Further, they migrate great distances quickly, resting for only one or a few days at a time, depending on weather conditions. For the above reasons, it is extremely unlikely that any Kirtland's warblers would occur within this 0.25 acre woodlot during clearing in September, and therefore direct effects from clearing of the 0.25 acre woodlot in September are discountable.

Because impacts to potential migratory stop-over habitat total only 0.5 acres, and 130 acres of deciduous forest, woody wetlands, and emergent herbaceous wetland habitat is available within and immediately adjacent to the project area, any indirect impacts to Kirtland's warbler from loss of migratory stop-over habitat are likely to be insignificant. Therefore the project may affect, but is not likely to adversely affect Kirtland's warbler.

<u>Bald Eagle</u>. The project lies within the range of the bald eagle, a federal species of concern. Both the Service (2012b) and ODNR (2011a) have identified two records of bald eagle nests in and near the Project Area. The "Fremont Nest" is located approximately one mile downstream and the "Portage Livery Nest" is located approximately one mile upstream of the Ballville Dam. These nests were both active in 2012. The Proposed Project is not expected to impact the Bald Eagle as work on the project would occur greater than 1-mile away from these nesting locations.

5.4.2.1.2 *State Listed Species*

A total of fourteen state listed species may be affected by the Proposed Action. Four of these species are federally listed (i.e. eastern prairie fringed orchid, Indiana bat, rayed bean, and Kirtland's warbler) and are discussed above. Two species of birds, northern harrier and trumpeter swan, may occur with the project area. However, these species are not known to breed in the Project area and occur transiently and are not expected to be affected by the Proposed Action due to mobility (Peterjohn and Rice 1991).

A total of eight state listed aquatic species have known records from the lower Sandusky River watershed and habitat that includes or potentially could include the Project Area. Those species are Western Banded Killifish, Greater Redhorse, River Redhorse, Threehorn Wartyback, Deertoe, Purple Wartyback, Kidney Shell, and Round Pigtoe. Potential impacts described for fish in Section 5.3.2.1 would also apply to listed fish in this section. The Western Banded Killifish was not collected near the project area in recent surveys but is likely present in wetlands near Lake Erie. Construction related turbidity would likely dissipate well before potential interaction with this species. Barbour et al. (1999) described both the Greater Redhorse and the River Redhorse as intolerant of anthropogenic disturbance. However, the Sandusky River is known to have very high suspended sediment loads that approach 2.5 times those of the

Maumee River on a per square mile basis (Limnotech 2010). Both Greater and River Redhorse are known to occur in the Sandusky River in the project area suggesting at least a moderate tolerance for turbid conditions. Construction related suspended sediment concentrations are not expected to exceed those generated by seasonal storm events and should have only minor, temporary effects on state listed fish species.

Stantec (2011a) surveyed for freshwater mussels in the Sandusky River between the Ballville Dam (RM 18.0) and the Hayes Avenue Bridge (RM 16.0) in September 2011. Seventy-nine live mussels, comprising 13 species were observed. No Federally listed taxa were found, however, one live Three-horned Wartyback (*Obliquaria reflexa*), an Ohio threatened species, was observed as were 23 Deertoe (*Truncilla truncata*), an Ohio Species of Concern. Freshwater mussels may be adversely impacted by one of four mechanisms: (1) direct injury from construction and/or the operation of heavy equipment; (2) stranding caused by stage changes resulting from demolition of the dam; (3) scour and mobilization of bed substrates resulting from increased stream power after demolition of the dam; and (4) increased sediment load to downstream reaches. Injury from construction would be avoided by limiting construction to areas near the dam. The exposed bedrock in the area immediately below the dam provides very poor habitat and no live mussels were found during 2011 surveys. Impacts from the pool drawdown and headward channel incision would be minimized by capturing and relocating stranded freshwater mussels to locations outside of the drawdown area. Relocation of mussels would be consistent with agency approved study plans.

The Proposed Action would cause short-term, temporary increases in sediment load downstream of the current dam location. Potential effects to freshwater mussels include physiological stress from elevated suspended sediment concentrations and habitat changes resulting from increased sediment load. Increased sediment load in rivers is a frequently cited cause for widespread mussel population declines (e.g., Brim Box and Mossa 1999). However, some studies indicate that freshwater mussels can endure short term environmental stressors by closing their valves and entering a quiescent state (Sheldon and Walker 1989, Haag 2012). In a review of sediment focused literature, Haag (2012) concluded that increased sedimentation was a plausible explanation for some localized extirpations but that there was “an almost complete lack of direct evidence” linking sedimentation to enigmatic freshwater mussel declines. Few studies have directly examined the impact of dam removal on downstream mussel populations.

Because of the emphasis on sediment control measures proposed for the Ballville Dam Project, it is anticipated that effects to downstream mussel populations, if any, would be short-term. Any adverse impacts would be offset by restored riverine habitat, elimination of a migratory barrier for fish (host) movement, and increased genetic exchange between isolated upstream and downstream populations. Further, both phases of demolition would be scheduled for the fall when stream temperatures are low and metabolic demand by mussels would also be low (Myers-Kinzie 1998) thereby minimizing the potential for physiological stress and mortality.

5.4.2.2 Post-Construction Effects

5.4.2.2.1 *Federally Threatened, Endangered, and Candidate Species, and Species of Concern*

Indiana Bat. The Indiana bat is not known to occur in the project area; however, restoration of the Sandusky River may be beneficial for the species. Improved water quality may provide increased insect production that could generate more prey for the species.

Northern long-eared Bat. Restoration of the Sandusky River may be beneficial for this species. Improved water quality may provide increased insect production that could generate more prey for the species.

Kirtland's Warbler. The Kirtland's Warbler is not known to occur in the project area. This species migrates through Ohio annually in the spring and autumn but is most often found near the shore of Lake Erie. Vegetation that grows within the former impoundment area may provide suitable migration stop-over habitat for the Kirtland's warbler, providing a benefit to the species.

Bald Eagle. There are currently two active Bald Eagle nests near the Ballville Dam. Removal of the dam as stated in the Proposed Action would release an undetermined amount of sediment that is currently stored behind the dam. Estimates indicated it could be nearly 400,000 CY. Bald Eagles may temporarily adjust their foraging patterns if fish are displaced from areas where the eagles normally fished due to sedimentation, but these impacts are expected to be insignificant, localized, and temporary. The overall benefit of the restoration project would provide more fish after the initial demolition of the dam and release of the sediment. Post-construction, the project would not result in take or other significant impacts to the Bald Eagle.

5.4.2.2.2 *State Listed Species*

Removal of the Ballville Dam would benefit state listed species at local and regional scales. At the local level, elimination of artificially-created lacustrine habitat associated with the dam impoundment would benefit the riverine ecosystem and continuity of aquatic habitat. Improvements to the structural and functional elements of aquatic habitat in the impounded reach of the Sandusky River would yield substantial improvements to Aquatic Life Uses. At the regional scale, an additional 22 miles of the Sandusky River would be opened to migratory fish species including the state-listed Greater Redhorse and River Redhorse. Both Redhorse species are known from upstream (Yoder and Beaumier 1986) and downstream (ODNR 2009) of Ballville Dam, so the Proposed Action would not dramatically alter their overall distributions. It would, however, eliminate a migration barrier two mobile species. Radio tagging studies of Greater Redhorse have documented spawning movements up to ten miles from the point of origin (Bunt and Cooke 2001). Low allelic richness has been documented in River Redhorse populations in rivers fragmented by dams (Reid et al. 2008). Demolition of Ballville Dam would restore the exchange of genetic material between currently isolated populations, potentially conferring additional fitness and resistance to extirpation. The Western Banded Killifish is not expected to benefit from increased access to the upper river due to its restricted distribution. The supply of coarse-grained sediments may also be restored to sediment starved reaches downstream of the dam potentially replenishing critical but diminishing spawning habitats for Greater and River Redhorse. The primary benefit of the project to state-listed mussels is the movement of host fish, leading to range expansion. After project completion, migration of fish hosts and attached mussel glochidia would be expanded approximately 20 miles (32.2 kilometers) upstream to the next barrier in Tiffin. The Deertoe, which uses the highly migratory Freshwater Drum as a host, would appear to be the most obvious beneficiary of increased fish movement. However, other mussels hosts such as the Rainbow Darter (host for Kidneyshell) and the common shiner (host for Three-horned Wartyback) are also migratory (Bunt et al. 2001), albeit to a lesser degree, and could promote colonization of these mussels in currently unoccupied areas. In contrast to the wide spread and long lasting benefits derived from the Proposed Action, any adverse impacts such as sediment deposition, suspended solids, and displacements are expected to be short term and temporary.

5.4.2.3 Mitigation Measures

Existing roads would be used to the maximum extent practicable to minimize impacts to forest and shrub habitat that may support Indiana bat or Kirtland's Warbler. Improvements that require tree cutting would adhere to seasonal restrictions (no tree clearing between April 1 and October 1) to ensure that direct impacts to Indiana bats, Northern long-eared bat, and Kirtland's warbler are avoided when possible. Clearing of the south work pad would occur prior to the October 1 date. In the event that tree clearing other than the south work pad is required between April 1 and October 1, summer surveys would occur to document the presence or likely absence of Indiana bats and/or Northern long-eared bats within the area of clearing. If either species is documented, adverse effects to the species would be avoided, or formal consultation under Section 7 of the ESA would be implemented.

In addition to the seasonal restrictions, rules regarding disturbance of bald eagle nest locations would be observed. No tree clearing would occur within 660 feet (201.2 meters) of the bald eagle nest or within any woodlot supporting a nest tree. Further, any work within 660 feet of a nest or within the direct line-of-site of a nest is restricted from January 15 through July 31. This would prevent disturbance of the eagles from the egg-laying period until the young fledge, which encompasses their most vulnerable times. In-stream work would be avoided during key spawning periods.

For aquatic species, after notching the dam and the drawdown of the impoundment begins, native live mussels located on the exposed ban/margins of the former impoundment would be recovered and relocated to suitable habitat in the Sandusky River upstream of the dam. It is expected that fish species would be able to retreat with the receding waters. The incremental notching of the dam would limit the spatial extent of the exposed bed such that areas could be effectively covered by rescue crews. Existing hydrographic survey data would be used to project target drawdown elevations to expose bed features that have potential to support dense mussel assemblages. This activity would be coordinated with the Service and ODNR. Relocated mussels would be periodically monitored to determine survival rates, and a monitoring report would be provided to ODNR and the Service.

As described in the Fish and Wildlife Section (5.3), the design for the Proposed Action employs the use of a notch with is intended to diminish the initial delivery of sediment to downstream reaches. Seeding of exposed sediments would be another tactic designed to restrict the export of stored sediment in the impoundment. By releasing smaller volumes of sediment over a longer time frame, adverse effects for aquatic habitats and species, including Greater Redhorse and River Redhorse would be minimized. The Proposed Action would also restrict the time period for demolition of the dam to the fall. The advantage of this strategy would be that water temperatures would be lower (and oxygen concentrations higher). The seasonal shift would minimize physiological stress in state listed fish that might occur as a result of higher suspended sediment concentrations.

A pre- and post-project monitoring plan is in place for aquatic populations utilizing the lower Sandusky river relating to the Proposed Alternative. Pre-project monitoring characterizing the current fish community, including redhorse species, in the area around the Ballville Dam, and to quantify migratory fish abundance has been completed (OEPA 2011a; Ross 2013). Fish assessment surveys will be completed periodically into the future to quantify potential responses in the fish community.

Lastly, Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects such as soil erosion, resulting from construction that could contribute to sediment deposition. Erosion control and stormwater management is required during construction through the National Pollutant Discharge Elimination System (NPDES) permitting program. Additionally, any work in the Sandusky River would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to ensure no significant impacts occur to rare, threatened, and endangered species.

5.4.3 Alternative 1 – No Action Alternative

5.4.3.1 Construction Effects

5.4.3.1.1 *Federally Threatened, Endangered, and Candidate Species, and Species of Concern*

Indiana Bat. The No Action Alternative would have no effect on the Indiana bat.

Northern long-eared Bat. The No Action Alternative would have no effect on the Northern long-eared Bat.

Kirtland's Warbler. The No Action Alternative would have no effect on the Kirtland's Warbler.

Bald Eagle. Work associated with the No Action Alternative would be located at the dam and would not extend to either upstream or downstream Bald Eagle nest. Therefore, no impacts to the Bald Eagle are expected from the No Action Alternative.

5.4.3.1.2 *State Listed Species*

Construction associated with rehabilitation of the dam would be expected to result in temporary impacts to two state listed fish species, the Greater Redhorse and the River Redhorse. The exact methods for construction are not known at this time, however, it is anticipated that some form of containment cell would be necessary upstream of the dam to dewater areas adjacent to the sluice gates. The containment cell would limit the amount of sediment exported downstream and would not be expected to adversely affect fish. Thick anoxic sediment deposits immediately upstream of the dam likely preclude utilization of these habitats by the Greater Redhorse and the River Redhorse. Work associated with the concrete repairs would also cause temporary displacement for state listed fish and wildlife species if present. However, The Western Banded Killifish is not known to occur in the area and would not be affected.

Sediment dominated habitats upstream of the dam are unsuitable for state listed freshwater mussels for many of the same reasons as fish. The area immediately downstream of the dam is also poor mussel habitat and no mussels were found in presence-absence surveys conducted in 2011 (Stantec 2011b). Therefore adverse effects to mussels would not be expected.

5.4.3.2 Post-Construction Effects

5.4.3.2.1 *Federally Threatened, Endangered, and Candidate Species, and Species of Concern*

Indiana Bat. Results of the No Action Alternative would have no effect on the Indiana bat.

Northern long-eared Bat. Results of the No Action Alternative would have no effect on the Northern long-eared Bat.

Kirtland’s Warbler. Results of the No Action Alternative would have no effect on the Kirtland’s Warbler.

Bald Eagle. Results of the No Action Alternative are not expected to affect the Bald Eagle.

5.4.3.2.2 *State Listed Species*

Operation of the dam would be similar to current operating conditions with the exception of annually opening the sluice gates to ensure their operation. Opening of the sluice gates may result in short discharges of sediment. However, discharges are expected to be negligible as repair of the gates would have required some sediment removal. Additionally, the opening of the gates is to ensure that they are operational and not intended to draw down the impoundment. It is expected that the opening and closing of the gates would occur within a 5 to 15 minute time period limiting sediment discharge. Any discharge would be expected to pass through the system to Sandusky Bay quickly based on its small size (Appendix A11). Therefore operation of the dam is not likely to impact state-listed fish or mussel species. However, implementation of the No Action Alternative would continue to prevent the upstream migration of state listed species of fish and mussels. It is likely that the continued passing of fine sediment from the watershed and the lack of course grained substrate recruitment would continue to degrade aquatic habitats used by state listed fish (i.e., Greater Redhorse and River Redhorse) and mussel species downstream of the dam.

5.4.3.3 Mitigation Measures

Sluice gates would only be opened for the minimal time necessary to demonstrate functionality. This would minimize the impact of sedimentation on state-listed aquatic species. Annual audits could also be conducted during storm events in colder weather to further minimize impacts to aquatic species.

Best Management Practices (BMPs) and acceptable maintenance procedures would be used to reduce or eliminate anticipated undesirable effects. Additionally, any maintenance in the Sandusky River would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to ensure no impacts occur to rare, threatened, and endangered species.

5.4.4 Alternative 2 – Rehabilitate Dam, Install Fish Passage Structure

5.4.4.1 Construction Effects

5.4.4.1.1 *Federally Threatened, Endangered, and Candidate Species, and Species of Concern*

<u>Indiana Bat</u>. No tree clearing is expected to occur as a result of Alternative 2. Therefore, Alternative 2 would have no effect on the Indiana bat.

<u>Northern long-eared Bat</u>. Alternative 2 would have no effect on the Northern long-eared bat.

<u>Kirtland's Warbler</u>. Alternative 2 would have no effect on the Kirtland's Warbler.

<u>Bald Eagle</u>. Work associated with Alternative 2 would be located at the dam and would not extend to either upstream or downstream Bald Eagle nest. Therefore, no impacts to the Bald Eagle are expected from Alternative 2.

5.4.4.1.2 *State Listed Species*

Impacts to state-listed species are the same as those described in Section 5.3.3.1.2. River Redhorse and Greater Redhorse would be temporarily displaced by activities related to construction of the fish ladder including pouring of concrete, modification of stream bed topography for the fishpass inlet and operation of heavy equipment in the channel.

5.4.4.2 Post-Construction Effects

5.4.4.2.1 *Federally Threatened, Endangered, and Candidate Species, and Species of Concern*

<u>Indiana Bat</u>. Results of Alternative 2 would have no effect on the Indiana bat.

<u>Northern long-eared Bat</u>. Results of Alternative 2 would have no effect on the Northern long-eared Bat.

<u>Kirtland's Warbler</u>. Results of Alternative 2 would have no effect on the Kirtland's Warbler.

Bald Eagle. Results of Alternative 2 are not expected to appreciably affect the bald eagle. The additional numbers of fish occurring upstream as a result of the fish elevator may provide more food for the bald eagle. However, due to the continued activity in this nest it is unlikely that this factor alone would appreciably impact the Bald Eagle.

5.4.4.2.2 *State Listed Species*

It is anticipated that the operation of a fish elevator system on Ballville Dam, with the inclusion of a fish sorting facility to withhold invasive species, would have negligible adverse impacts (e.g., stress from handling, exposure to infectious diseases from crowding) to state listed fish and host fish for state-listed mussel glochidia. However, positive impacts of this alternative on native species populations such as River Redhorse, Greater Redhorse, and freshwater mussel host species may depend on the behavioral characteristics and the physiology of each listed fish and host fish species. We could find no published examples of fish elevators for a dam of equal size to Ballville with a similar complement of species. At present it is uncertain how effective the fish elevator would be and mounting evidence suggests that passage efficiency would be low (Brown et al. 2013). Passage for non-game fish species has been poorly studied and little information is available. Greater Redhorse did successfully pass over a ladder in the Grand River in Ontario but entered this fishway at numbers far lower than their abundance (Bunt et al. 2001). Several fish species that serve as hosts for state listed freshwater mussels also passed over the Grand River ladders including Bluegill (host for Round Pigtoe), Bluntnose Minnow (host for Round Pigtoe), Longnose Dace (host for Three-horned Wartyback), and Rainbow Darter (host for Kidneyshell). These species also passed over in very low numbers. While a fish elevator would provide increased access for some species, it is expected that this alternative would have limited benefit to state-listed fish and mussels. Fish community integrity would continue to be low in the impounded section due to degraded habitat, altered hydraulics, poor water quality, and reduced aquatic invertebrate production.

Fish elevator systems are not used for downstream fish passage, meaning that individuals moving downstream would either be stopped by Ballville Dam or pass over the spillway, increasing the likelihood of mortality. For migratory species, such as Greater Redhorse and River Redhorse, which successfully navigate the elevator system and reproduce upstream of the dam, it is expected that larval mortality would be high but it is not possible to quantify how high at this time. Causes of mortality would include physical trauma from hydraulic forces as well as blunt force impacts (e.g., rocks, concrete, etc.). Small fish passing over the dam would likely be disoriented and subject to predation from fish holding below the dam.

5.4.4.3 Mitigation Measures

Construction and maintenance of the facility would require a USACE Dept. of Army Permit (Section 404 Clean Water Act and Section 10 Rivers and Harbors Act) and State of Ohio Water Quality Certification by OEPA (Section 401 Clean Water Act). All terms and conditions would be followed to ensure no impacts occur to rare, threatened, and endangered species.

Construction would be timed to avoid sensitive life history windows for rare, threatened, and endangered species in the project area (e.g. fish and mussel reproduction). Fish spawning for most species in the Sandusky River Project Area, including stat listed species occurs between March 15 and June 30. Sensitive life stages including egg incubation and larval emergence follow in the weeks after. In water work would be restricted to avoid these behaviors and would not be scheduled between March 15 and June 30 or August 1 and October 31.

Sorting facilities would be operated in the migration period to prevent non-native aquatic species from passing upstream.

Maintenance operations would be completed during non-spawning seasons (mid-June to March).

5.4.5 Alternative 3 – Dam Removal with Ice Control Structure

5.4.5.1 Construction Effects

5.4.5.1.1 *Federally Threatened, Endangered, and Candidate Species, and Species of Concern*

Indiana Bat. This alternative would result in clearing of 0.3 acres (0.1 hectares) of trees, but would adhere to seasonal clearing restrictions to ensure no direct impacts to the Indiana bat. Therefore, this action may affect, but is not likely to adversely affect the Indiana bat.

Northern long-eared Bat This alternative would result in clearing of 0.3 acres of trees, but would adhere to seasonal clearing restrictions to ensure no impacts to the Northern long-eared bat. Therefore, this action may affect, but is not likely to adversely affect the Northern long-eared bat

Kirtland's Warbler. No impacts to the Kirtland's warbler would be expected to occur as all clearing of potential migratory stopover habitat would be removed between October 15 to March 31, Therefore, this action may affect, but is not likely to adversely affect the Kirtland's warbler.

Bald Eagle. Impacts of construction on the bald eagle are the same as those described in Section 5.4.2.1.1.

5.4.5.1.2 *State Listed Species*

A total of fourteen state listed species may be affected by the Proposed Action. Four species are federally listed and addressed above. Two species of birds, northern harrier and trumpeter swan, may occur with the project area. However, these species are mobile and transient and are not expected to be affected by Alternative 3 due to mobility.

Construction effects on state listed fish and mussels would be consistent with those described in the Fish and Wildlife section (5.3.5.1) and for the Proposed Action in this Rare, Threatened, and Endangered Species section (5.4.2.1.2). Western Banded Killifish would not be adversely affected by Alternative 3 due to absence in the immediate project area. The principle difference between Construction Effects for Alternative 3 and the Proposed Action is the duration of exposure to increased suspended sediment concentrations. Greater Redhorse and River Redhorse have been identified as species that are intolerant of anthropogenic disturbance (Barbour et al. 1999). Alternative 3 could cause short term increases in physiological stress from increased concentrations as well altered foraging patterns. However, sediment concentrations are not expected to exceed those generated by seasonal storm events, so effects should be minor.

State listed mussels, Three-horned Wartyback and Deertoe may also be affected by short-term increases in sediment concentrations from construction activity. Concentrations may be higher in Alternative 3 in comparison to the Proposed Action but are still expected to be within the natural range of variation for the Sandusky River. Any adverse effects to state listed mussels would be short term and temporary.

5.4.5.2 Post-Construction Effects

5.4.5.2.1 *Federally Threatened, Endangered, and Candidate Species, and Species of Concern*

Indiana Bat. Impacts of this Alternative on Indiana bats are the same as those described in Section 5.4.2.2.1.

Northern long-eared Bat. Impacts of this Alternative on Northern long-eared bats are the same as those described in Section 5.4.2.2.1.

Kirtland's Warbler. Impacts of this Alternative on Kirtland's Warbler are the same as those described in Section 5.4.2.2.1.

Bald Eagle. Impacts of this Alternative on Bald eagles are the same as those described in Section 5.4.2.2.1.

5.4.5.2.2 *State Listed Species*

Post-Construction Impacts of this Alternative on State-listed species are similar to those described in the Fish and Wildlife Section 5.3.5.2 and in the Proposed Action Section 5.4.2.2.2. Adverse effects to Western Banded Killifish would be not expected due to the absence of this species from the Project Area. Under Alternative 3, the magnitude of sediment export from the impoundment would be higher than under the Proposed Action. Consequently Greater Redhorse and River Redhorse habitat downstream of the dam could be altered by the increased sediment load. This could potentially degrade spawning habitat and cause reduced foraging efficiency. State listed freshwater mussels would be at greater risk of burial from increased sediment aggradation.

5.4.5.3 Mitigation Measures

Mitigation measures listed for the Proposed Action (Section 5.4.2.3) would apply for Alternative 3 with the exception of tree clearing. Tree clearing for development of the north access road would occur between October 15 and March 31 to ensure no effects to Indiana bat or northern long-eared bats. This timeframe would also avoid impacts to the Kirtland's warbler during migration.

5.5 LAND USE

5.5.1 Impact Criteria

Consideration of the effects of the Proposed Action and alternatives on the human environment, which includes land use, must be included as part of an overall NEPA analysis. The following section addresses issues related to land use associated with the Project including: compatibility with local land use; zoning and comprehensive planning; compatibility with planned development; and impacts to landowners. No specific significance criteria are available for land use; however, if the project is not compatible with local land use, zoning, planned development, or if there would be long-term adverse impacts to landowners then there would be an impact.

5.5.2 Proposed Action

5.5.2.1 Construction Effects

The construction-related activity associated with the Proposed Action would occur on land owned by the City of Fremont. Most construction activities would occur immediately adjacent to the Ballville Dam and would not result in direct impacts to land uses. The Proposed Action would necessitate the construction of four temporary access roads.

Development of the access roads would require clearing of approximately 0.55 acres (0.22 hectares) of trees for development of the south workpad and the north access road. These properties are classified as low intensity-developed land. After project completion the south access road would be re-graded and reseeded. Therefore, this impact on existing land use would be short-term. The north access road will be partially restored; The portion of the north access road from County Road 501 to the work ramp would be removed, re-graded and reseeded, however the portion from County Road 501 through the wooded riparian area would remain in place for future access for removal of the debris from the ICS as well as future recreational access. While the impact of this road will be permanent, the footprint is very small (approximately 0.3 acres of woods converted to gravel access road) and the surrounding area will remain in existing cover. Therefore these impacts are minor. The equipment staging areas would be in locations currently utilized by power companies as a staging area, so they would be consistent with these land uses. The work ramp to be constructed on the spillway would be temporary and would be removed after removal of the dam. The modification of the seawall would be conducted on low-intensity developed land, and the impacts to this land would be short-term, and only occur while the modification is taking place. Therefore, its impacts on existing land use would be short-term and compatible with local land use, zoning, and planned development.

5.5.2.2 Post-Construction Effects

Land use, in the context of USGS National Land Cover Dataset (NLCD; 2006), would be impacted by decreasing the amount of open water by 20 acres (8.1 hectares) (Table 5-3). The former impounded area would revert to vegetated open space, increasing the total “Developed, Open Space” and “Emergent Herbaceous Wetlands” categories in the NLCD Classification. Additionally, areas that were formerly forested wetlands would change from wetland to deciduous upland forests. Table 5-3 shows quantitatively the land use before and after construction of the Proposed Action.

The removal of the dam and installation of the ICS would not be in conflict or change current zoning ordinances as a result of the Proposed Action. Therefore, the removal of the Ballville dam and construction of the ice control structures are compatible with the Ballville Township Zoning Map and the Existing and Future Land Use Map.

Table 5-3. Land uses within the Project Area

Land Use Classification	Percentage	Acres Prior to Proposed Action	Percentage After Proposed Action	Acres After Proposed Action
Open Water	28	147	24	127
Developed, Open Space	28	149	32	168
Developed, Low Intensity	5	27	27	27
Developed, Medium Intensity	<1	2	<1	2
Deciduous Forest	21	108	20	108
Grassland/Herbaceous	1	6	1	6
Cultivated Crops	13	67	13	67
Woody Wetlands	<1	1	<1	1
Emergent Herbaceous Wetlands	4	20	4	21
Total	**100**	**526**	**100**	**526**

Source: USGS 2006

Changes to individual property boundaries as a result of the dam removal, since the river's water elevation would be affected, are discussed further in Section 5.7. At this time, the exact physical change in the width and elevation of the Sandusky River upon removal of the dam is unknown; however, according to the Ohio law, the addition of dry land after the drawdown of a impoundment may extend property boundaries from the former edge of the impoundment to the new river's edge.

5.5.2.3 Mitigation Measures

Mitigation measures employed to lessen the impact to areas that would experience temporary impacts would include restoring access roads by reseeding and subsoil decompaction; repairing all inadvertently damaged tile lines through the south agricultural fields; and stabilizing newly exposed sediment in the former impoundment with seed or mulch. Mitigation measures related to property are further discussed in Section 5.7.

5.5.3 Alternative 1 – No Action Alternative

5.5.3.1 Construction Effects

There would be no land use or zoning impacts during the dam rehabilitation and rehabilitation to the sea wall during the No Action Alternative since there would be no changes to the existing shoreline. No trees would be expected to be removed for the No Action Alternative. The access to the dam to perform the repair and maintenance work would be on property owned by the City of Fremont; therefore, there would be no impacts to private property.

5.5.3.2 Post-Construction Effects

There would be no changes to land use or zoning from the operational phase of the No Action Alternative. In addition, there would be no impacts to landowners as a result of the long-term operation of the No Action Alternative.

5.5.3.3 Mitigation Measures

No mitigation measures are considered for land use as no impacts to land use would occur.

5.5.4 Alternative 2 – Rehabilitate Dam, Install Fish Passage Structure

5.5.4.1 Construction Effects

There would be no land use or zoning effects of the dam repair, rehabilitation and fish elevator construction phase of Alternative 2. In addition, access to the dam and fish elevator, to perform the repair and maintenance work, would be on property owned by the City of Fremont; therefore, there would be no impacts to private property. The fish elevator would be constructed on property currently owned by the City of Fremont on the left (north) abutment. The area where the fish elevator would be built is currently "low intensity developed" land cover, and this designation would not be expected to change with the addition of the fish elevator. No additional property would need to be acquired for this facility. In addition, this alternative would not impact the existing shoreline so there would be no impacts to property boundaries or property tax revenues. No trees would be cleared for this alternative. This alternative would be consistent with the Ballville Township Zoning Map and the Existing and Future Land Use Map for Ballville Township.

5.5.4.2 Post-Construction Effects

There would be no long-term impacts to surrounding land use as a result of the operation of the dam and fish elevator.

5.5.4.3 Mitigation Measures

No mitigation measures are considered for land use as no impacts to land use would occur.

5.5.5 Alternative 3 – Dam Removal with Ice Control Structure

5.5.5.1 Construction Effects

Land use effects would be similar to those described in the Proposed Action (Section 5.5.2.1). A total of 0.3 acres of land would be cleared of trees for development of the north access road. Development of a south access road would not be necessary for Alternative 3.

5.5.5.2 Post-construction Effects

The land use impacts of the operational phase of this alternative would be the same as those described for the Proposed Action (Section 5.5.2.2).

5.5.5.3 Mitigation Measures

Mitigation measures employed to lessen the impact to areas that would experience temporary access would include restoring access roads by reseeding and subsoil decompaction and overly compacted areas; repairing all inadvertently damaged tile lines through the south agricultural fields; stabilizing newly exposed sediment in the former impoundment with seed or mulch. Mitigation measures related to property are further discussed in Section 5.7.

5.6 RECREATION

5.6.1 Impact Criteria

This section evaluates the potential impacts of the Proposed Action and the alternatives to recreational experiences and opportunities both in the vicinity of the Ballville Dam and regionally. Effects on recreation would be considered significant if the project resulted in substantial restrictions on recreational access or reduction in the quality of the recreational experiences. Conversely, substantial increases in recreation opportunity and quality are also considered. Fishing and boating are the primary recreational opportunities that are present in the project area which would be discussed in this section. Potential impacts to park resources also are discussed.

5.6.2 Proposed Action

5.6.2.1 Construction Effects

5.6.2.1.1 *Fishing and Boating*

During phases 1 and 2 of the Proposed Action, there would be an impact to fishing and boating activity in construction areas at and around the dam and the ice control structure. Access to the construction area by angler and boaters would be prohibited for a period of 24 months while demolition occurs and restoration is completed. This impact would be temporary and fishing and boating would be allowed in these areas after project activities are complete.

Boating opportunities within the impoundment behind Ballville Dam would change upon completion of Phase 1 of the project. Upon notching the dam the water elevations would drawdown thus making smaller the surface area for boating in the impoundment. Formerly submerged hazards such as trees may break the surface during this period when water levels fall below the current dam height. This may impact larger recreational boats such as pontoon boats. Smaller boats such as canoes and kayaks would still have similar maneuverability on the smaller impoundment area. During this time, portage around the dam would still not exist. Because of the removal of the dam, drawdown of the impoundment, and restoration of the river, recreational boating may be temporarily restricted during removal of the dam until after project construction is completed.

Fishing below the dam occurs during various times of the year according to public comment and City of Fremont. During the construction period fishing would not be permitted in and around the dam due to safety concerns. Fishing in the impoundment may still be permitted during construction but the surface water area would be smaller.

When sediment is released from behind the dam and aggregated downstream, sediment may temporarily degrade fishing habitat. However as sediment moves downstream over time, this affect would be ameliorated.

Demolition of Ballville Dam and the subsequent release of sediments would result in localized accumulation (aggradation) of sediment in the reach downstream from the dam. The reach of the river near Brady's Island is potentially susceptible to sediment aggradation, particularly the side channel on the eastern end of the island. Therefore some short-term impacts to motorized watercraft navigation may occur there and elsewhere in the lower river. These impacts may inhibit movement of larger recreational boats. Smaller slip-boats such as Jon boats, canoes, and kayaks are not as likely to experience impacts.

Impacts to motorized watercraft navigation could occur in the reach near Brady's Island, and elsewhere in the lower river depending on water levels and water volumes. The rate of sediment migration and dispersal are dependent upon the flow regime over a period of years following removal of the dam. If the dam removal is followed by a succession of large flow events, the rate of sediment migration and redistribution of sediment would be more rapid. If flows are small, channel would likely respond less quickly. Furthermore, if it is assumed that 470,400 cubic yards (CY) would be exported following dam removal (consistent with Major et al. 2012) and that sediment would deposit on less than ¼ of the surface area available in the Sandusky River, Muddy Bay, and Sandusky Bay, then the depth of deposition would be approximately 3/8 of an inch (Appendix A11). Consequently, it is unlikely that Ballville Dam removal would cause long term impacts to navigation.

5.6.2.1.2 *Parks*

<u>Roger Young Memorial Park</u>. This park is on the north side of the Sandusky River opposite of Robert L. Walsh Memorial Park. It is situated above the City of Fremont's flood levy system and would not be subject to direct influences from the Project. Access to the river is not provided from this park for recreation; therefore, no impacts are expected to occur as a result of the project.

Robert L. Walsh Memorial Park. This park is on the southeast side of the Sandusky River opposite of Roger Young Memorial Park. It is situated above the City of Fremont's flood levy system and would not be subject to direct influences from Project. Access to the river for recreational fishing and boating would be maintained during and after the project. Therefore, no impacts are expected to occur as a result of the Project.

Portage Trail Park. This park is located upstream of the dam on the northern side of the river. Portage Trail Park is a privately owned park located along River Road in Ballville Township which provides forty-six RV sites, as well as tent sites for camping and river access. Access to the river for recreational fishing and boating upstream of the impoundment would not be impacted during the project. There is currently no improved boat ramp at this location but there are locations where unimproved access can be made (i.e. dragged up the bank). However, access downstream of the park may not be permitted in an effort to restrict usage during construction and restoration. This park would not be affected by noise or traffic associated with construction due to its location greater than 7,000 feet upstream.

River Cliff Golf Course. This park is located on the northeast side of the Sandusky River between the Tiffin Road Bridge and Roger Young Memorial Park. It is situated outside of the levy system and subject to flooding during high water events. Access to the river for recreational fishing and boating is not the primary purpose of this park; however, current access to the river would be maintained throughout the project.

Because the park is located in the floodplain of the Sandusky River it has the potential to be impacted by the project. Sediment transport modeling indicated that aggradation of sediment is likely to occur in downstream reaches, but that this aggradation would not result in increases of water surface elevations in excess of 1 foot (0.3 meters) through the leveed reach in Fremont. If "dry" conditions occur and maximum aggradation is more likely to be observed, sediment would be flushed out of the leveed section on the rising limb of the flood hydrograph before the peak flow occurs. This suggests that as the river is rising the sediment would be flushed through before its elevation inundated the golf course, therefore, sediment from the project would not be expected to impact the park. The most pronounced area of sediment aggradation appeared near the Highway 20 Bridge north of Fremont and resulted in a water surface elevation increase of less than 0.1 feet (0.03 meters). This location is several miles downstream of the River Cliff Golf Course. Localized shoaling of sediment could occur depending on various factors including, but not limited to, the flow regime, river morphology, and flow obstructions.

5.6.2.1.3 Other Recreational Activities

During the construction period, the impoundment area would be gradually drawn down and noises associated with construction activities would occur. Some recreational uses identified by local residents would be impacted by these activities. Trapping of snapping turtles and muskrat would gradually decline as habitat for these species is reduced during draw down. Similarly, waterfowl hunting opportunities would decrease as large numbers of waterfowl would not be likely to congregate in this area if the impoundment was not present and they may be disturbed by construction activity.

As described above, public access at the location of the dam would be restricted for safety purposes during construction activities. This would preclude uses such as camping, picnicking, hiking, and climbing near the dam during the construction period. These activities would continue unaffected in other areas of the project during the construction period.

5.6.2.2 Post-Construction Effects

5.6.2.2.1 *Fishing and Boating*

After completion of dam removal, opportunities would permanently change for boating. Larger boats such as pontoon style used for lake conditions would no longer be functional in the former impoundment area as it returns to a fast moving stream. Additionally, small boat (such as canoes, kayaks, and john boats) experiences would change from the slower moving pool experience to a faster flowing river experience due to the river elevation drop through the former impoundment and project construction area. The removal of the Ballville Dam would have a positive impact on river accessibility for boats moving between Tiffin and Sandusky Bay unimpeded when water levels permit.

Once dam removal is completed, fishing access in the area of the former dam would again be available. Fishing opportunities within the former impounded area would permanently change from lake-like fishing to stream fishing with the elimination of large pools due to elevation drop within the project area.

Over the long-term, the removal of the Ballville Dam would have a positive impact on recreational fishing in the Sandusky River, as well as in Lake Erie because it would open up a significant amount of spawning habitat to Walleye and other fish species that are important to the recreational fishing. More opportunity upstream of the dam for Walleye, White Bass, and Sauger fishing would be observed as well as more access points. The Sandusky River would likely become more productive and provide a greater fish diversity along a longer reach than currently available.

Over the past ten years, there has been a decline in the Walleye population in Lake Erie. These declines are generally attributed to habitat degradation but may also include low dissolved oxygen levels in the water, and heavy land runoff of phosphorus from agriculture, which contributes to algae blooms.

Jones et al. (2003) suggests that the removal of Ballville Dam along the Sandusky River would help improve the Lake Erie Walleye population by reconnecting 22 miles (35.4 kilometers) of free-flowing river to Lake Erie and providing Walleye access to new spawning habitat. An estimated 25 acres (10.1 hectares) of spawning habitat is available in the reach above the dam that could produce between 10,000,000 and 149,000,000 larval fish on an annual basis. This yield would be on average eight times greater than the Walleye yield in the habitats below the dam (Jones et. al., 2003). An increase in the Walleye fish population in the Sandusky River would have a positive impact on the Great Lakes and Sandusky River sport fishery.

White Bass and Yellow Perch also undertake migrations from Lake Erie to spawning habitats in the Sandusky River. The White Bass migration, in particular, is an important seasonal fishery. While White Bass and Yellow Perch in the Sandusky River and their associated population limiting factors have been studied less intensively than Walleye, it is reasonable to conclude that increased access to upstream spawning habitats would be beneficial. The Sauger was extirpated from the region and prior reintroduction attempts have proven unsuccessful. Because Sauger is a highly migratory species, increased connectivity between habitats resulting from removal of the Ballville Dam may make it possible to reestablish this species in the basin.

5.6.2.2.2 *Parks*

<u>Roger Young Memorial Park</u>. No impacts to this park are expected as a result of the Project.

<u>Robert L. Walsh Memorial Park</u>. No impacts to this park are expected as a result of the Project.

<u>Portage Trail Park</u>. After the Project is completed, if access to the river downstream of the park for recreational fishing and boating was restricted, it would be reinstated and allow for passage downstream to Lake Erie.

<u>River Cliff Golf Course</u>. No post construction impacts are expected as a result of the Project.

5.6.2.2.3 *Other Recreational Activities*

The Proposed Action would eliminate the impoundment area, which would likely eliminate some existing recreational uses identified by local residents, including trapping of snapping turtles and muskrat, because habitat for these species would no longer be present. Similarly, while waterfowl hunting would still be possible, large numbers of waterfowl would not be likely to congregate in this area if the impoundment was not present. It is unlikely that ice skating would be possible on the river once the dam is removed.

Other recreational activities would not be precluded by implementation of the Proposed Action. For example, the project area would continue to support a diversity of birds and would be available for bird watching. Likewise, camping, picnicking, hiking, and climbing among rocks along the river and near the location of the former dam would still be possible. The recreational “experience” may change for some users who were used to the area of the dam. In place of the dam and the “waterfall” experience, users would see and experience a flowing river.

5.6.2.3 Mitigation

Communication of river closure and access would be provided by the City of Fremont to ensure safe recreation for all resource users. Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects such as soil erosion, resulting from construction that could contribute to sediment deposition. The City would post signs upstream of the ICS warning recreational boaters that the structure may present a water hazard at certain flows.

5.6.3 Alternative 1 – No Action Alternative

5.6.3.1 Construction Effects

5.6.3.1.1 *Fishing and Boating*

Public access at the location of the dam would be restricted for safety purposes during rehabilitation activities. This would preclude some fishing opportunities immediately adjacent to the dam during rehabilitation activities.

5.6.3.1.2 *Parks*

Roger Young Memorial Park. No impacts to this park are expected as a result of the No Action Alternative.

Robert L. Walsh Memorial Park. No impacts to this park are expected as a result of the No Action Alternative.

Portage Trail Park. No impacts to this park are expected as a result of the No Action Alternative.

River Cliff Golf Course. No impacts to this park are expected as a result of the No Action Alternative.

5.6.3.1.3 *Other Recreational Activities*

Public access at the location of the dam would be restricted for safety purposes during rehabilitation activities. This would preclude uses such as camping, picnicking, hiking, and climbing near the dam during rehabilitation activities.

5.6.3.2 Post-Construction Effects

5.6.3.2.1 *Fishing and Boating*

No impacts to current conditions for fishing and boating would occur as a result of the No Action Alternative. Under the No Action Alternative, the Ballville Dam would remain in place and continue to act as a barrier to fish spawning habitat above the dam. There would be no impacts to existing boating under the No Action Alternative. With the Ballville Dam in place there would continue to be a permanent barrier between upstream river travel and the Sandusky Bay.

5.6.3.2.2 *Parks*

Roger Young Memorial Park. No impacts to this park are expected as a result of the No Action Alternative.

Robert L. Walsh Memorial Park. No impacts to this park are expected as a result of the No Action Alternative.

Portage Trail Park. No impacts to this park are expected as a result of the No Action Alternative.

River Cliff Golf Course. No impacts to this park are expected as a result of the No Action Alternative.

5.6.3.2.3 *Other Recreational Activities*

There would be no impacts to other existing recreational activities as a result of the No Action Alternative.

5.6.3.3 Mitigation Measures

No mitigation measures are proposed.

5.6.4 Alternative 2 – Rehabilitate Dam, Install Fish Passage Structure

5.6.4.1 Construction Effects

5.6.4.1.1 *Fishing and Boating*

Public access at the location of the dam would be restricted for safety purposes during rehabilitation activities and installation of the fish passage structure. This would preclude some fishing opportunities in areas immediately adjacent to the dam during construction activities.
Parks

Roger Young Memorial Park. No impacts to this park are expected as a result of Alternative 2.

Robert L. Walsh Memorial Park. No impacts to this park are expected as a result of Alternative 2.

Portage Trail Park. No impacts to this park are expected as a result of Alternative 2.

River Cliff Golf Course. No impacts to this park are expected as a result of Alternative 2.

5.6.4.1.2 *Other Recreational Activities*

Public access at the location of the dam would be restricted for safety purposes during rehabilitation activities and installation of the fish passage structure. This would preclude uses such as camping, picnicking, hiking, and climbing in areas immediately adjacent to the dam during construction activities.

5.6.4.2 Post-Construction Effects

5.6.4.2.1 *Fishing and Boating*

A fish passage structure would provide for potential movement of fish upstream of the existing Ballville Dam. However, this alternative would not restore the system connectivity and improve the hydrologic processes both below and immediately above the dam. Therefore, water quality issues resulting from sedimentation buildup behind the dam would remain, which could jeopardize the success of Walleye and other fish species to spawn upstream. Therefore, the degree of positive impact of this alternative to provide additional angling opportunities upstream is uncertain.

5.6.4.2.2 *Parks*

Roger Young Memorial Park. No impacts to this park are expected as a result of Alternative 2.

Robert L. Walsh Memorial Park. No impacts to this park are expected as a result of Alternative 2.

Portage Trail Park. No impacts to this park are expected as a result of Alternative 2.

River Cliff Golf Course. No impacts to this park are expected as a result of Alternative 2.

5.6.4.2.3 *Other Recreational Activities*

There would be no impacts to other existing recreational activities as a result of Alternative 2.

5.6.4.3 Mitigation Measures

No mitigation measures are proposed.

5.6.5 Alternative 3 – Dam Removal with Ice Control Structure

5.6.5.1 Construction Effects

5.6.5.1.1 *Fishing and Boating*

Impacts to Fishing and Boating from construction of Alternative 3 would be the same as those described in Section 5.6.2.1, but access to the construction area by angler and boaters would be prohibited only for a period of ten months. This impact would be temporary and fishing and boating would be allowed in these areas when project activities are complete.

5.6.5.1.2 *Parks*

Roger Young Memorial Park. No impacts to this park are expected as a result of Alternative 3.

Robert L. Walsh Memorial Park. No impacts to this park are expected as a result of Alternative 3.

Portage Trail Park. Access to the river for recreational fishing and boating would be maintained during the project. However, access downstream of the park may not be permitted during construction and restoration. This park would not be affected by noise or traffic associated with construction because it is over 7,000 feet (2,133.6 kilometers) upstream of the dam.

River Cliff Golf Course. Access to the river for recreational fishing and boating is not the primary purpose of this park; however, current access to the river would be maintained throughout the project.

Because the park is located in the floodplain of the Sandusky River it has the potential to be influenced by the project. It would be expected that suspended sediment concentrations would be largely influenced by storm events. High suspended solids concentrations would be high after storm events but return to normal levels quickly with decreasing discharge. Measureable effects of the dam removal activities are expected to dissipate within six to 12 miles (19.3 kilometers) downstream of the dam (Appendix A8). Impacts to surface water quality would be expected to return to normal as sediment moves through the system and deposits out.

5.6.5.1.3 *Other Recreational Activities*

Impacts to other recreational activities from construction of Alternative 3 would be the same as those described in Section 5.6.2.3, but impacts to recreation associated with construction activities would only occur for a period of ten months.

5.6.5.2 Post-Construction Effects

5.6.5.2.1 *Fishing and Boating*

The effects to fishing and boating from implementation of Alternative 3 are the same as those described in Section 5.6.2.2.1.

5.6.5.2.2 *Parks*

Roger Young Memorial Park. No impacts to this park are expected as a result of Alternative 3.

Robert L. Walsh Memorial Park. No impacts to this park are expected as a result of Alternative 3.

Portage Trail Park. After the Project is completed, access to the river downstream of the park for recreational fishing and boating would be reinstated and allow for passage downstream to Lake Erie.

River Cliff Golf Course. No impacts to this park are expected as a result of Alternative 3.

5.6.5.2.3 *Other Recreational Activities*

The effects to other recreational activities from implementation of Alternative 3 are the same as those described in Section 5.6.2.2.3.

5.6.5.3 Mitigation Measures

Communication of river closure and access would be provided by the City of Fremont to ensure safe recreation for all resource users. Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects such as soil erosion, resulting from construction that could contribute to sediment deposition. It would be recommended that signs be posted upstream of the ICS warning recreational boaters that the structure may present a water hazard at certain flows.

5.7 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

5.7.1 Impact Criteria

Consideration of the effects of the Proposed Action and alternatives on socioeconomic conditions must be considered as part of an overall NEPA analysis. Section 4906-13-07 of the Ohio Administrative Code (OAC) also requires consideration of socioeconomic conditions. In addition, per the requirements of Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations) and Executive Order 13045 (Protection of Children from Environmental Health Risks and Safety Risks), socioeconomic impacts must be assessed for potential disproportionate effects on minority and low-income communities and children, respectively. Socioeconomic impacts are evaluated in the context of Project Area, as well the surrounding region.

5.7.2 Proposed Action

5.7.2.1 Construction Effects

5.7.2.1.1 *Property*

Construction effects of the Proposed Action are not expected to significantly impact local residents or housing in the project area. Construction traffic hauling material either to or away from the project site may cause traffic delays along the haul route but such impacts would be expected to be short-term and temporary. All work on the north abutment would occur on land owned by the City of Fremont. Permission from any private land holdings would be received prior to accessing the project area (e.g. Ohio Power Company). There would be no displacements of residences or businesses or right-of-way acquisitions as a result of the dam removal project. In addition, the proposed project would not impact community cohesion; neighborhoods would not be split or isolated and residents would not be separated from community facilities.

5.7.2.1.2 *Business*

During the short-term, there would be positive impacts to employment in the vicinity of the dam removal project as a result of the increase in construction-related employment. A potential average of 10 construction jobs would be created by the dam removal activities, the construction of the ice control structure, the hauling of the debris off-site, and the post-construction landscaping activities. An average number of 10 construction workers were on site each day for the duration of another dam removal in the state of Ohio.

The Proposed Action would have positive short-term impacts to construction-related businesses during the dam removal activities. Businesses that would be positively impacted would include construction equipment rental businesses, food and lodging businesses, construction contractors, landscape businesses, and hauling businesses.

5.7.2.2 Post-Construction Effects

This project is part of the Great Lakes Restoration Initiative (GLRI). In 2007, the total cost of the GLRI, taking into account both the initial capital costs and the continuing operating costs, was an estimated $26 billion. Included in the GLRI are numerous projects in Ohio to restore watersheds and fish habitat. In addition to the significant ecological benefits of these projects in improving water quality and ecosystems, these projects have beneficial economic impacts. A study conducted by the Brookings Institution found that fully implementing the Great Lakes restoration strategy would generate $50 billion in long-term economic benefits; $30 billion to $50 billion in short-term benefits; and $50 million to $125 million in reduced costs to municipalities (The Brookings Institution, 2007). The engineering and environmental studies of the Ballville Dam removal and the costs for First Phase Removal of the Ballville Dam are included as two of 45 projects in the GLRI for river restoration, wetlands and habitat restoration, and other watershed projects in Ohio. Numerous studies (Provencher et al. 2008; Lewis et al. 2008; Kruse et al. 2006; Makombe 2003; Trout Unlimited 2001; and Loomis 1999) have been conducted on other small dam removal projects which identify general economic trends that can be applied to this project. Based on other small dam removal projects which have occurred throughout the United States, the removal of the Ballville Dam is expected to have positive economic benefits as a result of improved recreational fishing and boating and enhanced property values. These benefits are discussed in the following sections.

5.7.2.2.1 *Property*

A recent study by Provencher et al. (2008) investigated the impact on property values from dam removal projects. Based on a study of fourteen sites that either had a dam removed, had intact dams, or were located near free-flowing rivers, the authors made the following conclusions:

1. There was no noticeable increase in residential property price for shoreline frontage along small impoundments compared to frontage along free-flowing rivers.

2. Residential non-frontage property located in the vicinity of a free-flowing river is more valuable than identical property located in the vicinity of an impoundment.

3. Removing a dam had little impact on property values in the short run (2 years in the study) and increased property values in the long run, as the stream and its associated riparian zone matured to a “natural” free-flowing state.

A second study by Lewis et al. (2008) considered results of a hedonic property value analysis for multiple hydropower sites along the Kennebec River in Maine, including the former site of the Edwards Dam in Augusta, Maine. The effect of the removal of the Edwards Dam on the Kennebec River in Maine is examined through consumer’s marginal willingness to pay to be close to or distant from the dam site. Data from both before and after the dam was removed are used to estimate changes in marginal prices. A similar data set is also used to look at the effects of the remaining upstream dams on property values. The findings indicate that before the Edwards Dam was removed, a homeowner, on average, would be willing to pay an additional $2,000 to be ½ mile away from the dam. After removal, the willingness to be a ½ mile away reduces to $134. These results are significant at the 99% level, indicating that the post-dam removal setting was more desirable to home buyers than the setting with the dam in place additionally, the authors found smaller, though positive similar results for a community located nearly 20 miles upstream of the former Edwards Dam location that was adjacent to other dams (Lewis et al. 2008). They speculated that this may be due to long-term improvements in both recreational fisheries and water quality in the Kennebec River in the years since the dam was removed.

Although every area is different in terms of characteristics that determine residential property values, this study does suggest that the removal of the Ballville Dam would have little impact on property values in the vicinity of the dam over the short-term. Similar to the Edwards Dam removal study (Lewis et al. 2008), we expect recreational fisheries opportunities to increase upstream of the former dam location, and we expect water quality to improve (i.e., reduction in the occurrence of algal blooms, etc.). Over the long-term, the Provencher et al. (2008) and the Lewis et al. 2008 study suggest that property values in the vicinity of the dam may, in fact, increase as the river reverts back to its natural state and the riparian zone is re-established. Information provided during public comment has suggested a different opinion regarding property values. A licensed appraiser stating a familiarity with the residential properties adjacent to the north bank of the impoundment has expressed the opinion that property values would decline in monetary value as a result in removal of the Ballville Dam and loss of the impoundment.

It is difficult to know what change, if any, would occur to property values as a result of dam removal and loss of the impoundment. Values are influenced by a variety of market factors as well as personal preference. Some homeowners may value an impoundment over a river and the reverse as well. The opinion of the appraiser and perspective of peer-reviewed literature suggest that value may adjust due to the project but it is unclear as to what that value may be.

There would be impacts to private property taxes from the dam removal project due to newly exposed land along the Sandusky River. Changes to individual property boundaries may occur as a result of the dam removal, since the river's water elevation would be affected. At this time, the exact physical change in the width and elevation of the Sandusky River upon removal of the dam is unknown; however, according to the Ohio law, the addition of dry land after the drawdown of an impoundment may extend property boundaries from the former edge of the impoundment to the new river's edge.

In general, approximately 19 properties are expected to have no change in property lines (i.e. no increased acreage). Four of the 19 have deeds that indicate property to the middle of the Sandusky River and four others have deeds that are inconclusive as to property boundaries (Stantec 2011b). Approximately 48 properties could have an addition of acreage based on removal of the dam and drawdown of the impoundment. Changes were modeled assuming a wetted river width at the expected ordinary high water mark with a river flow at 6,000 cfs. Most deeds indicate that property lines are to edge of water. These changes could range from a gain of less than 0.25 acre to greater than five acres per property, depending on the river course after removal. If property values increase in the long term due to an increase in taxable acreage from addition of the newly exposed areas, tax revenues to Ballville Township could increase. This could also represent a greater tax burden on individual property owners.

After the drawdown of the impoundment, approximately 12 properties along the southern upstream shore of the former impoundment would experience exposed sediment as the shore line recedes. To bolster sediment stability and riparian restoration, permission to seed the newly exposed sediment would be requested. Some properties in other areas of the former impoundment may experience a similar increase in exposed shoreline, however dependent on conditions may not be conducive for seeding. Seeded and non-seeded areas would gradually vegetate in response to the new water line. At first herbaceous plants would grow, but after several years, woody plants would begin to appear. Over time, these areas would become floodplain forests.

5.7.2.2.2 *Business*

Over the long-term, there could be potential increased employment resulting from the additional fisheries production that may be realized by the removal of the dam. These impacts are difficult to calculate but could result from increased fishing equipment sales, increased boat rentals, increased food and lodging expenditures and other recreational expenditures that would support increased jobs. Similarly, the removal of the dam as a barrier on the Sandusky River would potentially have positive impacts on recreational businesses such as liveries, tackle shops, campgrounds, and other river oriented businesses. Other businesses that have the potential to see positive impacts include hotels, restaurants, gas stations, and other retail stores that provide goods for recreationalists and anglers.

5.7.2.3 Environmental Justice

Executive Order 12898 signed on February 11, 1994 requires that each Federal agency shall, to the greatest extent possible allowed by law, administer and implement its programs, policies, and activities that affect human health or environment so as to identify and avoid “disproportionately high and adverse” effects on minority and low-income populations. In order to comply with this order, an Environmental Justice analysis was conducted for the project area of the Ballville Dam project. The project area is comprised of parts of three U.S. Census blockgroups (391439613001, 391439613002, and 391439613004). The percentage of minority population for these blockgroups is 3.2 percent, 21.4 percent, and 4.1 percent, respectively (U.S. Census Bureau 2010; U.S. Census Bureau 2011). The percentage of the study area below poverty is 14.1 percent. Because the EJ populations within the project area are not considered to be significant portion of the population (defined as 40% or more), the project would not have a disproportionately high and adverse effect on minority and low-income populations.

5.7.2.4 Mitigation Measures

To determine the impacts to boundaries of private property along the Sandusky River, a survey of the bordering property owners within the affected impoundment would be completed following the construction phase of the project. This survey would delineate more precise property boundaries which could be used to determine impacts to individual property boundaries. The individual property boundaries would be dealt with legally on a case by case basis. Surveys would occur within five years after project completion. This would provide a reasonable time period for the Sandusky River to realize its new course.

5.7.3 Alternative 1 – No Action Alternative

5.7.3.1 Construction Effects

There would be minor construction-related activity to make the necessary repairs and rehabilitation to the existing dam to bring it into compliance with the Ohio State Dam Safety Standards. In addition, there would be on-going maintenance at the dam. A potential of five to ten construction jobs would be needed for the duration of the rehabilitation. These activities would be relatively minor and would not result in permanent impacts to employment.

5.7.3.1.1 *Property*

No impacts to housing or local residents would occur as a result of rehabilitation of the dam. All work would occur on property owned by the city of Fremont.

5.7.3.1.2 *Business*

Under the No Action Alternative, there would be temporary positive impacts to local businesses. The No Action Alternative would have positive short-term impacts to construction-related businesses during the dam rehabilitation activities. Businesses that would be positively impacted would include construction equipment rental businesses and food and lodging businesses. There would be positive impacts to employment in the vicinity of the dam removal project as a result of the increase in construction-related employment, however, the rehabilitation would only increase employment temporarily in year one. There would be no business or residential displacements.

5.7.3.2 Post-Construction Effects

5.7.3.2.1 *Property*

Under the No Action Alternative, there would be no impacts to housing. The community surrounding the Ballville Dam would remain unchanged.

The City has indicated that increases in the cost of water rates may be required to carry out this alternative. If this increase occurred, it could have financial impacts on local residents.

5.7.3.2.2 *Business*

Over the long-term, the No Action Alternative may contribute to the continued decline of the Walleye fishery both in Sandusky River and in Lake Erie, in addition to adverse impacts to other recreational fisheries. This is due to the degradation of existing spawning habitat and its limited amount within the downstream reach of the Sandusky River. As a result of these declines, continued adverse impact to the local and regional economy due to decreased tourism and continued reduced water quality in the impoundment would be expected. In addition to the direct impacts on anglers, a decline in the Great Lakes fishery including those in the Sandusky River and Sandusky Bay area could also result in adverse impacts to fishery-dependent workers and businesses, including marinas, slip rentals, vacation rentals, resorts, and bait and tackle shops.

5.7.3.3 Environmental Justice

The effect of the No Action Alternative on Environmental Justice is the same as the effect described in Section 5.7.2.3.

5.7.3.4 Mitigation Measures

No mitigation measures are proposed for the No Action Alternative.

5.7.4 Alternative 2 – Rehabilitate Dam, Install Fish Passage Structure

5.7.4.1 Construction Effects

5.7.4.1.1 *Property*

There would be no impacts to housing or local residents as a result of Alternative 2. All work would occur on property owned by the City of Fremont. The facilities associated with the fish elevator would be built near the existing carbon feed building and there would be little change to the surrounding landscape.

5.7.4.1.2 *Business*

There would be positive impacts to employment during the construction activity, which would include the construction of the fish elevator, as well as the concrete repairs to the dam, and stabilization of the seawall. A potential of five to ten construction jobs would be needed for the duration of the repairs and construction of the fish elevator. Alternative 2 would have positive short-term impacts to construction-related businesses during the construction activities. Businesses that would be positively impacted would include construction equipment rental businesses, landscaping businesses, and food and lodging businesses. There would be positive impacts to employment in the vicinity of the dam removal project as a result of the increase in construction-related employment, however, the repairs would only increase employment temporarily in year one. There would be no business or residential displacements and the community surrounding the Ballville Dam would remain unchanged in the long-run.

5.7.4.2 Post-Construction Effects

5.7.4.2.1 *Property*

There would be no expected impacts to housing as a result of Alternative 2. The community surrounding the Ballville Dam would remain unchanged.

The City has indicated that increases in the cost of water rates may be required to carry out this alternative. If this increase occurred, it could have financial impacts on local residents.

5.7.4.2.2 *Business*

During the operation of the fish elevator, there would be a few new jobs created to operate the fish elevator and sort unwanted fish from the elevator. It is expected that less than ten full-time jobs would be created.

It is not certain that the long-term operation of the fish elevator would have a positive impact on the Great Lakes fishery. While a fish elevator would provide increased access for some species, it is expected that this alternative would continue to limit fish migration in the Sandusky River because not all species can or would use an elevator. Fish community integrity would continue to be low in the impounded section due to degraded habitat, altered hydraulics, poor water quality, and reduced aquatic invertebrate production. A moderate beneficial intensity level was assigned based on the current poor condition of native migratory species (e.g., Walleye) populations in the Sandusky River and the potential to improve upstream fish passage with a properly constructed and maintained fish passage facility. The efficacy of the fish passage to improve fisheries populations upstream of the dam is uncertain.

5.7.4.3 Environmental Justice

The effect of this Alternative on Environmental Justice is the same as the effect described in Section 5.7.2.3.

5.7.4.4 Mitigation Measures

No mitigation measures are proposed for Alternative 2.

5.7.5 Alternative 3 – Dam Removal with Ice Control Structure

5.7.5.1 Construction Effects

5.7.5.1.1 *Property*

The socioeconomic impacts on Property of Alternative 3 would be the same as those described in Section 5.7.2.1.1 except that they would extend over a shorter time period. Unlike the Proposed Action, which would occur over a period of approximately 24 months, Alternative 3 would be completed within ten months.

5.7.5.1.2 *Business*

The socioeconomic impacts on Business of Alternative 3 would be the same as those described in Section 5.7.2.1.2 except that they would extend over a shorter time period. The construction-related socioeconomic impacts, which include short-term increases in construction-related employment, as well as economic benefits to businesses that provide construction-related services or supplies, would be experienced over a ten month period.

5.7.5.2 Post-Construction Effects

5.7.5.2.1 *Property*

Post-construction effects for Alternative 3 would be the same as those described in Section 5.7.2.2.1.

5.7.5.2.2 *Business*

Post-construction effects as a result of Alternative 3 would be the same as those described in Section 5.7.2.2.

5.7.5.3 Environmental Justice

The effect of this Alternative on Environmental Justice is the same as the effect described in Section 5.7.2.3.

5.7.5.4 Mitigation Measures

To determine the impacts to boundaries of private property along the Sandusky River, a survey of the bordering property owners within the affected impoundment would be completed during the design phase of the project. This survey would delineate more precise property boundaries which could be used to determine impacts to individual property boundaries. The individual property boundaries would be dealt with legally on a case by case basis. Surveys would occur within five years after project completion. This would provide a reasonable time period for the Sandusky River to realize its new course.

5.8 CULTURAL AND HISTORIC RESOURCES

5.8.1 Impact Criteria

The evaluation of the effects/impacts to cultural resources (e.g., historic properties and archaeological resources) as a result of implementation of the Proposed Action and alternatives follows criteria established by Section 106 of the National Historic Preservation Act (NHPA). Under Section 106, "an adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of a property's location, design, setting, materials, workmanship, feeling, or association (36 CFR § 800.5(a)(1)." As discussed in Section 4.8, the Area of Potential Effect (APE) for the Proposed Action is considered the dam pool itself and surrounding parcels within the dam's viewshed.

5.8.2 Proposed Action

5.8.2.1 Construction Effects

The Ballville Dam is eligible for listing on the NRHP under Criteria A and C. Additionally, the dam and former hydroelectric plant are together considered to be eligible for listing on the NRHP as a Historic District under Criteria A and C. These criteria were defined in Section 4.8. The former hydroelectric plant is not within the APE; however, due to its association with the Ballville Dam, it is considered eligible for the association with early electricity production and the development of a regional power grid in north-central Ohio. The Service has determined that removal of the dam would have an Adverse Effect on the Ballville Dam but not on the former hydroelectric plant (Appendix D2). The Proposed Action would permanently remove the dam, thus removing it from eligibility for listing on the NRHP. Due to the permanency of the action, this adverse effect is considered a significant impact.

A farmhouse located along South River Road was determined to be eligible for the NRHP under Criterion C as an excellent example of Queen Anne-style design. The Service has determined that the dam removal would have No Adverse Effect on the Jacob King Farmhouse (Appendix D2).

In addition to the NRHP-eligible properties discussed above, it was determined after the completion of the Phase I field survey that there could be potential remnants of the Tucker Dam, located approximately 4,500 feet (1,371.6 meters) upstream of the Ballville Dam. The lowering of the waterline from the dam removal project may expose this feature. The structure, if present, cannot be surveyed or evaluated against the NRHP criteria for evaluation without an extensive underwater investigation and potentially extensive excavation of any material that is likely concealing the structure. Therefore, the Tucker Dam would only be assessed if the structure was found and it was possible to access without extensive excavation during the drawdown of water as a result of Phase 1 and 2 of the Proposed Action. A Programmatic Agreement has been finalized to address this possibility.

5.8.2.2 Post-Construction Effects

After completion of the Proposed Action the only evidence of the Ballville Dam's existence would be recorded in photographs and a Historic American Buildings Survey/Historical American Engineering Record. These documents would be maintained and archived at the Birchard Public Library.

5.8.2.3 Mitigation Measures

In accordance with Section 106, the Service has completed Section 106 consultation to identify measures to avoid, minimize, or mitigate the adverse effects of the proposed project on the Ballville Dam. The Service and the Consulting Parties, with input from the Interested Parties, signed a Programmatic Agreement (PA, Appendix D1) to address mitigation of adverse impacts to the Ballville Dam and, as needed, the Tucker Dam. The Consulting Parties include the City of Fremont, ODNR, OEPA, the Ohio State Historic Preservation Office (OHPO), and the USACE. Ballville Township, Sandusky County Historical Society, and the Rutherford B. Hayes Presidential Center are considered to be Interested Parties in the Section 106 consultation process. A detailed inventory of dams in Ohio contained in the comprehensive list maintained by the ODNR, constructed between 1880 and 1930, less than 50 feet tall and less than 800 feet long would be completed as per the PA to mitigate for Criterion A. While most of the inventory would consist of the listing of relevant characteristics (distilled into a paragraph description with their various attributes) for each dam, a more extensive background context and Ohio Historic Inventory Form would be completed for the hydroelectric dams identified. An additional, brief 5-7 page summary of the history of hydroelectric power generation in Ohio would also accompany the inventory forms. Additionally, the consulting parties would complete a recordation comparable to the Historic American Buildings Survey / Historic American Engineering Record *(HABS/HAER)*. Minimally, work would consist of a heightened visual recordation of the Ballville Dam before and during demolition and would include close-up photographs and line drawings, as needed, to document the dam's internal construction. To complete the recordation, ODNR, in consultation with the City and other consulting parties as appropriate, would hire an outside professional contractor to compile the information for archival purposes. This information would be recorded before and during the removal of the Ballville Dam to mitigate for Criterion C.

Mitigation for Tucker Dam would be addressed as needed and would follow the guidelines laid out in the PA (Appendix D).

5.8.3 Alternative 1 – No Action Alternative

5.8.3.1 Construction Effects

Under the No Action Alternative, repairs and rehabilitation would be made to Ballville Dam that would stabilize the dam and sea wall and bring the dam into compliance with the Ohio State Dam Safety Standards. These activities would not result in impacts to the dam that would affect its eligibility for the NRHP.

5.8.3.2 Post-Construction Effects

Under the No Action Alternative, there would be no long-term impacts to cultural resources. The rehabilitation implemented as part of the No Action Alternative would stabilize the dam and sea wall, helping to ensure the dam's long-term viability. There would be no long-term impacts to the dam that would adversely affect the dam's eligibility for the NRHP.

5.8.3.3 Mitigation Measures

No mitigation measures are proposed. Rehabilitation would not impact the dam's eligibility by adversely affecting the dam or the hydro plant.

5.8.4 Alternative 2 – Rehabilitate Dam, Install Fish Passage Structure

5.8.4.1 Construction Effects

There would be no adverse effects to the Ballville Dam's eligibility for inclusion on the NRHP as a result of the dam repair and rehabilitation phase of Alternative 2. The fish elevator would be marginally visible and would not be expected to diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Therefore, implementation of Alternative 2 would not be an adverse effect to the Ballville Dam.

5.8.4.2 Post-Construction Effects

There would be no long-term effects of Alternative 2 on the historic integrity of the Ballville Dam. Under this alternative, the dam and sea wall would be stabilized, helping to ensure the dam's long-term viability. There would be no long-term impacts to the dam as a result of the installation of the fish lift that would adversely affect the dam's eligibility for the NRHP.

5.8.4.3 Mitigation Measures

No mitigation measures are proposed. Rehabilitation of the dam or installation of the fish elevator would not impact the dam's eligibility by adversely affecting the dam or the hydro plant.

5.8.5 Alternative 3 – Dam Removal with Ice Control Structure

5.8.5.1 Construction Effects

Alternative 3 would result in the same effects to Cultural and Historic resources as described in Section 5.8.2.1.

5.8.5.2 Post-Construction Effects

Alternative 3 would result in the same effects to Cultural and Historic resources as described in Section 5.8.2.2.

5.8.5.3 Mitigation Measures

The mitigation measures for Alternative 3 would be identical to those described in Section 5.8.2.3.

5.9 VISUAL RESOURCES

This section describes the Project's effects on visual resources in the project area and impoundment viewshed. The viewshed also includes those public roads with direct line of sight of the Project and its various components.

5.9.1 Impact Criteria

The area of analysis for the evaluation of scenic quality includes the vicinities and areas within sight lines of the Ballville Dam and impoundment, ICS, and construction/demolition access and staging areas. To determine the significance of effects on scenic resources, the viewshed was evaluated based on the changes that would occur as a result of the Proposed Action and alternatives.

5.9.2 Proposed Action

5.9.2.1 Construction Effects

Phase I of the Project would start a sequence of temporary visual impacts to approximately 66 residential and business-owned properties adjacent to the impoundment. Creation of the south access road would have little visual impact overall, but the seven property owners opposite of the dam would begin to see the small clearing and development of a work pad along the south abutment. Construction equipment used for notching the dam would not be expected to be visible for more than one or two days. The seven homes north of the dam would have a direct line of site of the Phase I activities. These residences would have daily views of the bare drawdown margins until vegetation is established. It would be expected that seeded sediment would not be aesthetically pleasing until vegetation germinates and begins to grow (one to two weeks). However, they would be looking through an active storage yard for the Ohio Power Company, partially obscuring visual impacts resulting from Phase I. The south access road for initial notching of the dam would continue to exist until completion of the project(approximately 24 months).

Phase 2 of the Project would focus most of the impacts associated with dam removal and ICS construction at the location of the existing dam and several hundred feet downstream as well as the staging area north of the dam. During dam removal activities, there would be a ramp built to allow construction equipment to reach the top of the south spillway. The ramp would be required for access to the top of the south spillway to begin demolition. This would result in a temporary visual impact to properties adjacent to the dam construction area for approximately seven months. Construction impacts at the staging areas located at the AEP storage yard would be negligible since these areas have already been used for equipment storage.

The construction of the ICS would require equipment within the river, which would be an adverse visual impact to properties adjacent to the river downstream of the dam in the vicinity of the ICS work. The access ramp would be partially removed to allow for construction of the northern most piers of the ICS. Impacts associated with demolition of the dam and construction of the ICS, however, would be temporary and would only last until the ice control structure is completed. These work areas would have limited visibility to most of the public. Views from Cemetery Road and South River Road would have limited visibility.

Phase 3 of the project would focus primarily on the sea wall modification and grading of the stream bed near the former dam location. Visual impacts would be temporary in nature and include construction equipment working in the stream and around the sea wall.

5.9.2.2 Post-Construction Effects

The Sandusky River is a State designated Scenic River. Removal of the dam is consistent with the program priorities established by the ODNR Scenic Rivers Program, which include the following: protect riparian buffer and stream habitat; dam removal; and watershed planning. In accordance with the Ohio Wild, Scenic and Recreational River Act, approval of the Director of ODNR would be required prior to the construction of the ICS (§1547.82 ORC).

Removal of the dam would provide the river the opportunity to revert back to a free flowing river system similar to those areas both upstream of the impoundment and downstream of the dam. Roughly one year would pass between the initial notch and impoundment drawdown and completion of the restoration of the construction area at the dam. During this time riparian margins may lack vegetation while seeding occurs and vegetation establishes. Areas formerly inundated and void of vegetation may be comprised of bare sediment for a short period of time, and may be more susceptible to sloughing and erosion. However, design of the Proposed Action takes these potential effects into account, slowing the drawdown to prevent a sudden collapse of river banks, and seeding to establish vegetation.

Areas within the former impoundment are not readily visible to the public. Views from Cemetery Road and South River Road may include portions of the former impounded area, depending on presence of trees and season.

Private residences with property bordering the impoundment would have daily views of the bare drawdown margins until vegetation is established. The seeding plan calls for immediate seeding and planting of exposed areas to minimize erosion and mobilization of sediments. We anticipate that vegetation would begin to establish within 2 weeks of the drawdown, if weather permits. Floodplain elevations would decrease in the areas behind the former Ballville Dam as the impoundment dewaters and reverts back to a riverine flow regime. The impounded area would reduce in size to an approximate average width of 175 feet (53.3 meters). The floodplain width would be, in general, consistent through most of the lower Sandusky River until the flood control reach.

The planting plan (Appendix A6) requires immediate seeding with herbaceous plant seeds and planting of containerized trees. During the first growing season after dam removal, residents whose properties are adjacent to the former impoundment could expect to see primarily herbaceous vegetation comprised of grasses and forbs along the sides of the river that are exposed from the drawdown of the former impoundment. The river itself would also be visible, and would range in size depending on the season of the year and recent precipitation events as seen upstream and downstream of the current impoundment. Over many years, trees would likely establish in the area of the former impoundment. Depending on the elevation of the landowner's home, the height of the vegetation, the width of the riparian area, and the distance to the stream each landowner's ability to view the river may vary. As vegetation is established, the current views these residences have would likely be replaced by views of an established riparian corridor and a restored river system.

Construction of the ICS would introduce a new structure on the Sandusky River. The piers would extend approximately 10 feet above grade depending on the river bed; however, the piers would be uniform at their top elevation. Removal of the dam would provide visibility of this new structure from anglers and those using the river for recreation. During leaf-off periods, residences within direct line of site primarily upstream would be able to see the structures. Those residences upstream are approximately 30 feet (9.1 meters), or higher, above the top of the structure.

5.9.2.3 Mitigation Measures

The ICS final design would take into consideration the use of materials that allow for the piers to blend in with their surroundings in order to lessen their visibility. Additionally, periodic debris removal would occur in order to avoid unsightly debris dams. Immediate seeding and planting of exposed sediment in the former impoundment area will limit the view of bare ground or mudflats to a minimal amount of time.

5.9.3 Alternative 1 – No Action Alternative

5.9.3.1 Construction Effects

There would be temporary visual impacts to seven properties adjacent to the dam related to construction equipment in the vicinity of the dam. These impacts would be short-term and would be removed after the repair and rehabilitation work of the dam is completed.

5.9.3.2 Post-Construction Effects

There would be no long-term visual impacts of the No Action Alternative; the Ballville Dam would remain in place and the viewshed would remain unchanged. Annual operation of the sluice gates would occur to ensure that the gates are operational but not to draw the impoundment down. Drawdown may be necessary only if additional rehabilitation or maintenance is necessary. This is expected to occur approximately every 20 years.

5.9.3.3 Mitigation Measures

Mitigation measures would include repairing and replacing components of the dam in such a way as to keep the current look and functionality of the dam after rehabilitation. Development of a cyclical and methodical inspection/repair schedule would help prolong the dam's ability to serve the City while keeping the same visual impression.

5.9.4 Alternative 2 – Rehabilitate Dam, Install Fish Passage Structure

5.9.4.1 Construction Effects

The visual impacts of this alternative are the same as those described in Section 5.9.3.1. In addition, construction of the fish passage structure would occur at the north abutment. There would be additional visual impacts to properties adjacent to the dam from the construction equipment at this location. However, these impacts would be temporary, short-term, and minor and would end when construction activities are complete.

5.9.4.2 Post-Construction Effects

A properly designed and constructed fish lift would be marginally visible to properties adjacent to the dam and not expected to result in significant visual impacts after construction. This is because the lift system would be housed in a building along the north abutment that would also provide a sorting facility. The upstream race allowing fish to move upstream without getting caught in the spill current would be obstructed from view by the sea wall. Visual impacts of the new fish lift system building and tailrace would not significantly alter the overall appearance of the Ballville Dam.

5.9.4.3 Mitigation Measures

Mitigation measures would include repairing and replacing components of the dam and fish lift system in such a way as to keep the current look and functionality of the dam after rehabilitation with little change other than an additional building on the north abutment. Development of a cyclical and methodical inspection/repair schedule would help prolong the dam and fish lift systems ability to serve the City while keeping the same visual impression.

5.9.5 Alternative 3 – Dam Removal with Ice Control Structure

5.9.5.1 Construction Effects

The visual impacts of this Alternative are the same as those described in Section 5.9.2.1; however they would occur over a shorter duration of approximately ten months.

5.9.5.2 Post-construction Effects

The long-term visual impacts of this alternative would be the same as those described for the Proposed Action Section 5.9.2.2.

5.9.5.3 Mitigation Measures

Mitigation measures would be the same as those for the Proposed Action.

5.10 TRANSPORTATION AND TRAFFIC

This section describes how the Proposed Action and alternatives could affect the area's transportation facilities and traffic. This discussion includes a qualitative analysis of potential impacts to the local roadways and regional transportation system.

5.10.1 Impact Criteria

For the purposes of this document, effects would be significant if they resulted in one or more of the following conditions:

- An alternative conflicted with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the traffic roadway system.
- An alternative conflicted with local, county, or Ohio Department of Transportation (ODOT) regulations related to truck traffic.
- Traffic related to the implementation of any of the alternatives created safety issues, i.e., traveling onto and off roadways with high speeds, or traveling on routes that presented potential conflicts with automobiles.
- Construction-related traffic created potential safety issues for pedestrians.

5.10.2 Proposed Action

5.10.2.1 Construction Effects

The Proposed Action would require the development of several temporary access roads throughout the duration of the project (approximately 24 months). These access roads would connect to the local roadway system and would be removed and restored, where applicable, after the project is completed.

Activities that would impact traffic on local roadways include: the intermittent transport of construction materials and equipment to the project site; transport of waste materials and equipment from the site to a disposal area; and the travel of construction workers to and from the construction site. The greatest traffic flow effects would be nearest to the construction sites and would impact the roads that would be utilized for the hauling route. These impacts would be temporary and would only occur during the period of dam removal and ICS construction activities. It would be the responsibility of the Contractor to identify the disposal area for the waste materials. The greatest traffic flow effects would be nearest to the construction sites. The local roads that would likely be utilized by the construction vehicles include the following:

- County Road 501 (Oakwood Street);

- Buckland Avenue (Creek 132);
- Laird Drive;
- Yingling Road;
- County Road 53;
- West Hurdic Road (County Road 201);
- River Road (County Highway 132);
- Tiffin Road and Bridge (County Highway 53);
- Cole Road (County Road 221); and
- N. Plank Road (Ohio 53).

These roads are identified on Figure 4-8. The roads within the vicinity of the project are owned and maintained by Ballville Township, Sandusky County, ODOT, or the City of Fremont. It is not anticipated that the proposed construction activities would require the closure of any of the local roads. Any minor traffic safety conflicts would be mitigated through best management practices. The contractor would be responsible for ensuring that construction vehicles enter and exit local roadways in a safe manner and, if necessary, provide flag persons in accordance with Ohio Department of Transportation (ODOT) standards. Installation of signage and proper construction traffic management would also be implemented to minimize traffic safety effects near the construction sites.

ODOT permit requirements would be followed for the construction equipment and hauling of waste materials to the disposal site. In addition, local ordinances regulating the operation of oversize or overweight vehicles on local streets would be followed. The Ballville Township's zoning ordinance does not have specific regulations regarding the operation of large or heavy vehicles on their streets. The City of Fremont, located immediately north of Ballville, requires a permit for operating oversize or overweight vehicles on their streets. In addition, Fremont has designated truck routes within the City limits. Both Tiffin Street and Buckland Avenue are identified as truck routes within the city limits of Fremont.

5.10.2.2 Post-Construction Effects

There would be no long-term or permanent traffic volume increases or long-term changes in traffic patterns that would occur as a result of the Proposed Action. Once the dam is removed and the ICS is in place, traffic on local and regional roadways would return to the pre-construction levels. Any incremental transportation impacts associated with this alternative would be temporary and would occur during the approximate two year construction period.

There are no designated bikeways or state-designated public recreational trails in the project area. Access to the project area by pedestrians and bicyclists would be controlled by “No Trespassing” signage and appropriate gating.

5.10.2.3 Mitigation Measures

The following measures would be undertaken to mitigate potential impacts to local roadways during construction activities for the Proposed Action:

- It is recommended that an analysis of existing road conditions and bridge weight capacities be conducted prior to project implementation to determine whether these facilities would be able to withstand the weight and frequency of the truck trips during the dam deconstruction period.

- Following the construction work, an analysis of post project condition of the roadways and bridges utilized for the haul routes should be completed to determine if the facilities sustained any damage that should be repaired. Damages would be addressed by the prime contractor responsible for the overall project.

- The construction plans would include a note that the contractor shall keep streets affected by the construction free of dirt, sediment, or mud. In addition, the contractor may be directed to perform street cleaning periodically or on a regular interval if excessive amounts of dirt or mud are present along the street.

- ODOT permit requirements would be followed for the construction equipment and hauling of waste materials to the disposal site. The City of Fremont requires a permit for operating oversize or overweight vehicles on their streets. In addition, Fremont has designated truck routes within the City limits. Local ordinances regulating the operation of oversize or overweight vehicles on local streets would be followed.

5.10.3 Alternative 1 – No Action Alternative

5.10.3.1 Construction Effects

Under the No Action Alternative, repairs and rehabilitation would be made to the existing dam to bring it into compliance with Ohio State Dam Safety Standards and maintenance of the structure would be undertaken to ensure continued compliance. It is not anticipated that the proposed construction activities would require the closure of any of the local roads. The repair and maintenance actions would require construction vehicles to access the site but the number of vehicle trips required would not result in significant short-term or long-term impacts to the local or regional transportation system. The contractor would make a final determination regarding which roads would be used to access the project area. Construction vehicles would access the site from County Road 501 (Oakwood Street). Any additional permits needed to access the site would be procured by the contractor. No significant short-term impacts to the local or regional transportation system are anticipated as a result of this alternative.

5.10.3.2 Post-Construction Effects

There would be no significant changes to the local or regional transportation system from existing conditions as a result of the operation or maintenance of the No Action Alternative.

5.10.3.3 Mitigation Measures

Because this alternative would not result in significant changes to the local or regional transportation system either during the rehabilitation repairs or the long-term operation and maintenance of the existing dam, no mitigation measures would be required.

5.10.4 Alternative 2 – Rehabilitate Dam, Install Fish Passage Structure

5.10.4.1 Construction Effects

The impacts on Transportation and Traffic from implementation of Alternative 2 are the same as those described in Section 5.10.3.1. In addition, the installation of the fish elevator would require equipment and materials to be moved to the left (north) abutment.

5.10.4.2 Post-Construction Effects

There would be no significant impacts to the local or regional transportation system during the operation and maintenance of this alternative over the long-term. Any increases in truck trips to access the site that would result from the installation of the fish elevator would be relatively minor and would be accommodated on the local roadway system with appropriate permits if necessary.

5.10.4.3 Mitigation Measures

There are no transportation impacts anticipated from the construction or operation of this alternative; therefore, no mitigation measures are recommended for this alternative.

5.10.5 Alternative 3 – Dam Removal with Ice Control Structure

5.10.5.1 Construction Effects

The impacts to Transportation and Traffic from this Alternative are the same as those described in Section 5.10.2.1. However, this alternative would be completed within a ten month period. Construction vehicles would access the site from County Road 501 (Oakwood Street). Any additional permits needed to access the site would be procured by the contractor. Because several construction activities may be done concurrently under this Alternative, the traffic impacts from construction vehicles utilizing local roads are likely to be greater than those under the Proposed Action, but not significantly greater, and over a shorter duration.

5.10.5.2 Post-Construction Effects

There would be no long-term or permanent traffic volume increases or long-term changes in traffic patterns that would occur as a result of this alternative. Any incremental transportation impacts associated with this alternative would be temporary and would occur during the ten month period. After the construction phase, the traffic levels on the local roads would return to pre-construction levels.

There are no designated bikeways or state-designated public recreational trails in the project area. Access to the project area by pedestrians and bicyclists would be controlled by "'No Trespassing" signage and appropriate gating.

5.10.5.3 Mitigation Measures

Mitigation measures would be the same as those for the Proposed Action.

5.11 AIR QUALITY

This section discusses potential air quality impacts from the Proposed Action and alternatives. A discussion of the area of analysis, significance criteria, and impacts for each of the alternatives is provided.

5.11.1 Impact Criteria

There are no state or local regulations or ordinances which regulate air quality at construction sites or emissions of construction vehicles. Air quality in Sandusky County is regulated by federal regulations as detailed below.

- Clean Air Act (40 CFR 50-88): The Clean Air Act (CAA) is the comprehensive federal law that regulates air emissions from stationary and mobile sources. This law authorizes the Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and public welfare and to regulate emissions of hazardous air pollutants. National ambient air quality standards were established for the criteria pollutants which include: Carbon Monoxide (CO), Ozone (O_3), Particulate Matter ($PM_{2.5}$/PM_{10}), Mobile Source Air Toxics (MSAT), NO_2, and SO_2.

- General Conformity (40 CFR 93, Subpart B): The Clean Air Act requires the development of a State Implementation Plan (SIP) and requires federal actions to conform to the SIP.

The area of analysis includes Sandusky County, Ohio. Sandusky County is currently in attainment for all criteria pollutants, which include: $PM_{2.5}$, Sulfur dioxide (SO_2), Nitrogen oxides (NOx), Carbon monoxide (CO), and $PM_{10.}$ Air quality impacts would be significant if the effects would cause an air quality standard to be violated.

5.11.2 Proposed Action

5.11.2.1 Construction Effects

Vehicle exhaust and fugitive dust emissions from dam removal activities would result in temporary, minor increases of VOC, NO_x, CO, and PM emission levels in the local construction area. Fugitive dust would be generated during construction as a result of grading of the access roads and staging areas, dam removal activities, and construction traffic on the unpaved roads. Because construction activities would be phased over two years under the Proposed Action, there would be several periods of construction activity where construction-related emissions would be generated.

The construction-related air quality effects would be relatively short-term in nature and would cease when the project is completed. The air quality effects would be localized to the project area and the vicinity of the equipment staging areas. There also could be increased emissions from construction vehicles on local roadways. The project related emissions are not likely to be detectable at the county level, and mitigation measures would be implemented to reduce emissions during construction activities.

5.11.2.2 Post-construction Effects

There would be no long-term air quality impacts as a result of this project. Any areas that are exposed to sediment from the draw-down of the river would be reseeded to minimize fugitive dust. In addition, the south access road and portions of the north access road would be re-vegetated and returned to their original condition which would also minimize fugitive dust.

5.11.2.3 Mitigation Measures

Measures that would be used to reduce emissions during construction activities include the following:

- Ensure that construction equipment, on-road construction equipment, and trucks used to transport materials to or from the construction sites are equipped with engines that meet the applicable emission standards.

- Reduce unnecessary idling through the use of auxiliary power units, electric equipment, and strict enforcement of idling limits.

- The contractor shall be responsible for providing dust control measures. Dust control operations shall be performed on a periodic basis and/or as directed by the owner to alleviate or prevent the fugitive dust within the project work limits.

- The contractor shall keep streets affected by the construction free of dirt, sediment, or mud. The Contractor may be directed to perform street cleaning periodically or on a regular interval if excessive amounts of dirt or mud are present along the street.

5.11.3 Alternative 1 – No Action Alternative

5.11.3.1 Construction Effects

Vehicle exhaust and fugitive dust emissions from dam removal activities would result in temporary, minor increases of VOC, NOx, CO, and PM emission levels in the local construction area. There would be minor, temporary, and localized vehicle exhaust and fugitive dust emissions from the dam and sea wall rehabilitation and maintenance activities to be conducted as part of the No Action Alternative. However, these emissions are not expected to be significant and would not result in air quality impacts.

5.11.3.2 Post-Construction Effects

There would be no significant air quality impacts as a result of the continued operation of the dam.

There would be minor air quality effects resulting from construction equipment operation and vehicle emissions during maintenance activities at the dam. However, these impacts would not be significant and would be short-term in duration.

5.11.3.3 Mitigation Measures

Mitigation measures would be the same as for the Proposed Action.

5.11.4 Alternative 2 – Rehabilitate Dam, Install Fish Passage Structure

5.11.4.1 Construction Effects

Impacts to air quality from Alternative 2 are the same as those described in Section 5.11.3.1. Vehicle exhaust and fugitive dust emissions from dam removal activities would result in temporary, minor increases of VOC, NOx, CO, and PM emission levels in the local construction area. Due to construction of the fish elevator structure, this alternative may result in a minor increase in vehicular emissions and fugitive dust. The air quality effects from the construction activity would be short-term, minor, and localized, and would not result in significant air quality impacts.

5.11.4.2 Post-Construction Effects

The fish elevator would operate by electricity and not require a combustible engine and, therefore, would produce no emissions. As a result, there would be no long-term air quality impacts from the fish elevator.

On-going maintenance activities at the dam would result in minor increases in vehicle emissions and fugitive dust. These increases would be short-term and limited to the duration of the maintenance activities.

5.11.4.3 Mitigation Measures

Mitigation measures would be the same as for the Proposed Action.

5.11.5 Alternative 3 – Dam Removal with Ice Control Structure

5.11.5.1 Construction Effects

The effects on Air quality from Alternative 3 are the same as those described in Section 5.11.2.1; however these impacts would only occur over a ten month period. Emissions would be greater during construction of this alternative as the construction would be more focused during the ten month period compared to the Proposed Action. However impacts are still expected to be minor, temporary, and localized, and not significant.

5.11.5.2 Post-Construction Effects

There would be no long-term air quality effects as a result of this alternative. Air quality in the project vicinity would return to pre-construction levels.

5.11.5.3 Mitigation Measures

Mitigation measures would be the same as for the Proposed Action.

5.12 NOISE

5.12.1 Impact Criteria

The area for analysis for noise impacts associated with the Ballville Dam Removal Project includes the areas in proximity to the Ballville Dam and the areas where construction activities would occur. Impact significance is generally associated with violations of any Federal, state, or local ordinances regulating noise levels.

There are no Federal or State regulations applicable to noise levels from construction activity. Noise levels in the project area are regulated by local laws and policies. Ballville Township, where the dam is located, does not have any noise ordinances within their zoning regulations. The City of Fremont, located approximately 0.4 miles (0.6 kilometers) northeast of the Ballville Dam, exempts equipment used for public purposes from its noise regulations (Codified Ordinances of Fremont, Ohio, Chapter 1121, Purposes, Compliance and Performance Standards, §1121.04, Performance Standards). The work associated with dam demolition and ICS construction where the bulk of the work is to be completed is owned by the City of Fremont. Therefore, no impact criteria are available for noise.

5.12.2 Proposed Action

5.12.2.1 Construction Effects

Construction activities associated with the Proposed Action are expected to cause short-term noise effects on the receptors within 3,200 feet (975.4 meters) of the construction site (Section 4.12). Those noise receptors within 3,200 feet of the dam are depicted on Figure 5-8 and include:

- Two cemeteries (Oakwood and St. Joseph’s),
- The western edge of River Cliff Golf Course
- Lutz Elementary School
- Residences/buildings north of the Sandusky River including the following areas, relative to the dam: extending West to the intersection of Tucker Road and Buckland Avenue;

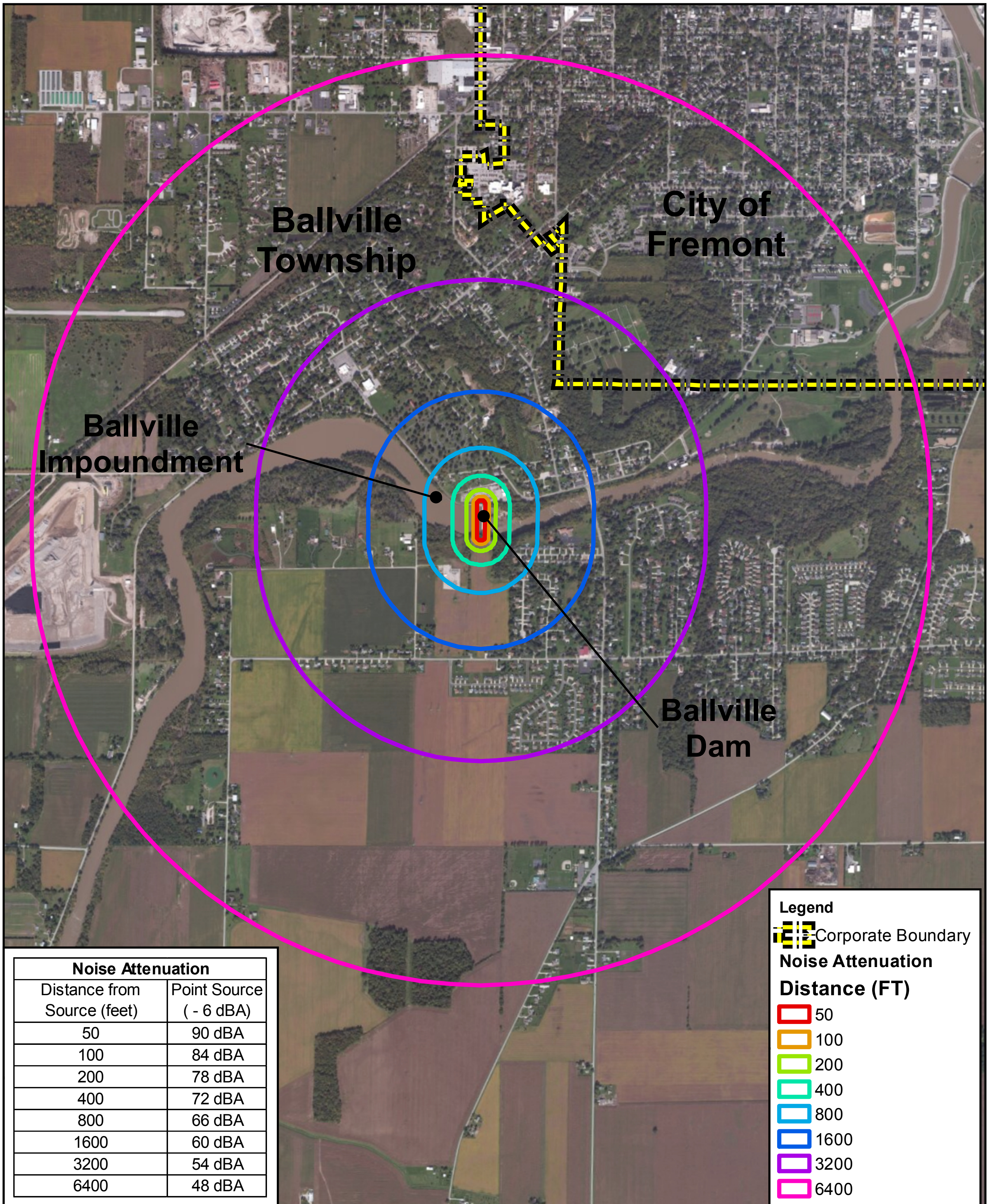
extending northwest as far as Roselawn Drive and Martin Avenue; extending north as far as the intersection of Buckland Avenue and 3rd Avenue; extending northeast as far as Canfield Street; and extending east as far as the western edge of River Cliff Golf Course.

- Residences/buildings south of the Sandusky River, including the following areas, relative to the dam: extending east as far as Williams Drive; extending south as far as Wisteria Drive; and extending west as far as W. Cole Road and Laird Road.

There would be increased noise at many receptors within 3,200 ft. of the Proposed Action. Noise would be loudest at those receptors closest to the construction area and would dissipate gradually over distance. Construction noise would likely be difficult to detect beyond 3,200 ft.

Effects on the nearest receptors and neighboring community noise levels during construction would result from noise from the construction equipment and from truck traffic. The level of effect would depend on the noise characteristics of the equipment and activities involved, such as the duration of the activity, construction schedule, and distance from receptors. Noise levels can vary widely depending on the phase of construction, which includes clearing access roads, notching the dam, construction of ICS, demolition of the dam, modification of the sea wall, and restoration of the impacted area. For the Proposed Action, noise levels would be highest during Phase 2 and Phase 3, when demolition of the dam, construction of the ICS, and heavy daily truck traffic would occur.

Typical noise levels from construction equipment that are likely to be encountered during the Proposed Action are presented in Table 5-4. Noise from the mounted impact hammer and dump trucks would be expected to be the most common noise sources. The noise generated by a mounted impact hammer is considered “impact noise” which is intermittent and has an amplitude that is great in relation to its duration, compared with the noise from dump trucks, which has a lower sound level which is sustained over a longer period. All work would be completed during daytime hours and would be temporary in nature.



Noise Attenuation	
Distance from Source (feet)	Point Source (- 6 dBA)
50	90 dBA
100	84 dBA
200	78 dBA
400	72 dBA
800	66 dBA
1600	60 dBA
3200	54 dBA
6400	48 dBA

Basemap:
BING

Noise Attenuation at the Project Site

N W E S

U.S. FISH & WILDLIFE SERVICE

U.S. DEPARTMENT OF THE INTERIOR MARCH 3, 1849

Ballville Dam Project

0 750 1,500 Feet

Figure 5-8

Table 5-4. Noise generator reference decibel (dBA) maximum level (L_{max}) at 50 feet

Equipment Description	L_{max} at 50 feet (dBA)	Impact Device (Yes or NO)
Backhoe	78	No
Chain Saw	84	No
Concrete Mixer Truck	79	No
Concrete Pump Truck	81	No
Concrete Saw	90	No
Dozer	82	No
Drill Rig Truck	79	No
Dump Truck	76	No
Excavator	81	No
Flat Bed Truck	74	No
Front End Loader	79	No
Mounted Impact Hammer (hoe ram)	90	Yes
Pickup Truck	75	No
Pumps	81	No
Rock Drill	81	No

Source: www.fhwa.dot.gov/environment/noise/construction_noise/handbook

The estimated ambient outdoor L_{eq} noise levels for a quiet location, based on USEPA data, are 40 dBA for daytime and 30 dBA for nighttime. Noise levels for common occurrences are included for comparison to the noise levels for construction equipment in the project area (Navajo 2008):

- Refrigerator in a home is 50 dBA
- A normal conversation between two people is approximately 60 dBA
- Freeway traffic is approximately 70 dBA at 50 feet
- Average city noise is 80 dBA
- A power lawnmower is approximately 90 dBA.

There are various natural conditions that can reduce noise over distance such as vegetation, topography, temperature and other meteorological variables. These are further affected by the site condition. A “hard site” exists when the site is made up of water, concrete, and/or hard-packed soils. The standard attenuation rate for a hard site is 6 dB per doubling of distance from a point source and 3 dB for a line source. Those areas that are “softer” include sites where ground cover and normal unpacked earth is more absorptive of noise. These sites may add 1.5 dB for doubling of distance (Table 5-5). Based on these factors, there would be increased noise at the identified receptors during the construction period but the impacts would be temporary and would cease at the completion of the project. The noise levels at these receptors would be somewhat attenuated by the distance of the construction activity and the presence of natural conditions such as trees and vegetation between the noise source and the noise receptors. Due to the presence of vegetation and groundcover in the vicinity of the dam, the soft site noise reduction criteria can be applied to this area (Table 5-5).

Table 5-5. Example of noise reduction for both construction point source and line source over distance from a 95 dBA source

Distance from Source (feet)	Point Source (-6dB)	Soft Site Point Source (-7.5dB)	Line Source (-3dB)
50	90	90	90
100	84	82.5	87
200	78	75	84
400	72	67.5	81
800	66	60	78
1,600	60	52.5	75
3,200	54	45	72
6,400	48	37.5	69

Source: Washington State Dept. of Transportation 2013

While no actual ambient noise readings are available for the project location, the estimated ambient outdoor L_{eq} noise levels for a quiet location, based on USEPA data, are 40 dBA for daytime and 30 dBA for nighttime. Beyond 3,200 feet, using the soft site point source attenuation formula, the construction noise would be expected to be less than 45 dBA, and would not represent a significant noise impact relative to the surrounding noise.

Noise impacts would be most significant at receptors closest to the dam. The closest receptors are the homes situated north of the River along the south side of Cemetery Road, and these lie within approximately 400 feet (121.9 meters) of the construction area. Noise in this area could be as loud as 67.5 dBA during construction activities. However, the sea wall would help dampen the noise during Phases 1 and 2 by increasing the elevation deflection of the construction noise to the receptors on the north side of the river. The closest receptors on the south side of the river are the homes located on the west end of River Drive. These homes are within approximately 800 feet (243.8 meters) of the construction area. Noise in this area could be as loud as 60 dBA during construction activities. However, receptors on the south side of the Sandusky River sit approximately 42 feet (12.8 meters) above the level of the dam, thereby breaking the line-of-sight with the dam and providing a buffer to the noise from the site. Receptors further from the construction site would experience lower noise levels, as indicated in Table 5-5.

Currently it is not known what route trucks would travel while either delivering or removing materials for the project. Traffic noise would periodically increase during different phases of the project temporarily impacting those residences and businesses along the route. Further details are provided in Section 5.10 for transportation and traffic.

5.12.2.2 Post-Construction Effects

There would be no long-term adverse noise impacts as a result of the removal of the dam and installation of the ice control structure. Conversely, over the long-term, noise levels at the dam location would be reduced as the sound of water topping the spillway would no longer be present.

5.12.2.3 Mitigation Measures

Construction-related noise impacts would be reduced to acceptable levels through the implementation of mitigation measures including the following:

- The Contractor would be responsible for maintaining all construction equipment to comply with noise standards (e.g., exhaust mufflers, acoustically attenuating shields, shrouds, or enclosures);

- Construction activities would be scheduled to reduce impacts caused during sensitive time periods, i.e. nighttime, weekends, and holidays.

- Limit the number and duration of idling equipment on site.

- When possible, schedule truck loading, unloading, and handling operations to minimize on-site construction noise.

- Utilize shields, mufflers or other noise attenuation devices for equipment operated by internal combustion engines when possible.

- Keep the public informed when work would take place, keep a telephone log of complaints and review for opportunities to minimize noise emissions when appropriate.

- Notification of receptors prior to specific noise events (e.g. prior to start of construction, prior to dam removal, etc.)

To minimize noise impacts to sensitive receptors along the haul route, the contractor should identify a route that limits the exposure to sensitive receptors, if possible. In addition, local roads that are designated haul roads should be utilized.

5.12.3 Alternative 1 – No Action Alternative

5.12.3.1 Construction Effects

Under the No Action Alternative, there would be limited noise effects due to the use of construction equipment associated with the repair and maintenance of the dam and sea wall. These noise impacts would be short-term and would occur within the immediate vicinity of the dam. There would be short term impacts from noise during construction for receptors within 1,600 ft. Those noise receptors within 1,600 feet (487.7 meters) of the dam are depicted on Figure 5-8 and include:

- Oakwood Cemetery

- 39 Residences/buildings north of the Sandusky River including the following areas, relative to the dam: extending north and west to Oakwood Cemetery; and east to the intersection of Tiffin Road and River Street

- 71 Residences/buildings south of the Sandusky River, including the following areas, relative to the dam: extending east as far as the intersection of Tiffin Road and River Drive; extending south as far as W. Cole Road; and extending west as far the third residence on Lair Road.

Construction equipment such as trucks, excavators, and dozers could produce noises up to 82 dBA (Table 5-4).

While no actual ambient noise readings are available for the project location, the estimated ambient outdoor L_{eq} noise levels for a quiet location, based on USEPA data, are 40 dBA for daytime and 30 dBA for nighttime. Using the soft site point source attenuation formula of -7.5 dBA per doubling of distance, beyond 1,600 feet, the construction noise would be expected to be less than 45 dBA, and would not represent a significant noise impact relative to the surrounding noise (Table 5-6).

Table 5-6. Example of noise reduction for both construction point source and line source over distance from an 82 dBA source

Distance from Source (feet)	Point Source (-6dB)	Soft Site Point Source (-7.5dB)	Line Source (-3dB)
50	82	82	82
100	76	74.5	79
200	70	67	76
400	64	59.5	73
800	58	52	70
1,600	52	44.5	67
3,200	46	37	64
6,400	40	29.5	61

Source: Washington State Dept. of Transportation 2013

Noise impacts would be most significant at receptors closest to the dam. The closest receptors are the homes situated north of the River along the south side of Cemetery Road, and these lie within approximately 400 feet (121.9 meters) of the construction area. Noise in this area could be as loud as 59.5 dBA during construction activities. However, the sea wall would help dampen the noise during Phases 1 and 2 by increasing the elevation deflection of the construction noise to the receptors on the north side of the river. The closest receptors on the south side of the river are the homes located on the west end of River Drive. These homes are within approximately 800 feet (243.8 meters) of the construction area. Noise in this area could be as loud as 52 dBA during construction activities. However, receptors on the south side of the

Sandusky River sit approximately 42 feet (12.8 meters) above the level of the dam, thereby breaking the line-of-sight with the dam and providing a buffer to the noise from the site. Receptors further from the construction site would experience lower noise levels.

5.12.3.2 Post-Construction Effects

There would be no long-term changes to the existing noise environment in the vicinity of the existing dam that would result in noise impacts to the surrounding community. There would be minor noise impacts during the maintenance activities undertaken under the No Action Alternative. These impacts would be short-term and would cease at the completion of the maintenance activity. These impacts would not be significant.

5.12.3.3 Mitigation Measures

Noise mitigation measures undertaken by the contractor during construction would further limit the noise to acceptable levels at the sensitive receptors. These measures include the use of equipment that complies with noise standards (e.g., exhaust mufflers, acoustically attenuating shields, or enclosures) and scheduling construction activities to reduce daytime and nighttime noise impacts. Receptors would be notified prior to specific noise events (e.g. prior to start of construction, prior to dam removal, etc.).

5.12.4 Alternative 2 – Rehabilitate Dam, Install Fish Passage Structure

5.12.4.1 Construction Effects

The noise effects from the repairs and rehabilitation to the dam and stabilization of the sea wall are the same as those described in Section 5.12.3.1. In addition, construction of the fish elevator would produce additional noise in the area adjacent to the north (left) abutment of the dam.

5.12.4.2 Post-Construction Effects

There would be no long-term noise impacts of this alternative because the operation of the mechanical fish elevator system is not expected to result in noise greater than the ambient noise levels of the water flowing over the dam. In general, fish elevators operate at a dBA level at or below the level of water cresting the overflow section of dams. The most notable sound is the tipping of the elevator (Personal communication, Ken Sprankle, U.S. Fish and Wildlife Service CT Field Office). The elevator system would be contained within a building further dampening the sound of the machinery.

5.12.4.3 Mitigation Measures

Mitigation measures would be similar to the No Action Alternative.

5.12.5 Alternative 3 – Dam Removal with Ice Control Structure

5.12.5.1 Construction Effects

The noise effects from implementation of Alternative 3 are similar to those described in Section 5.12.2.1, but the period of noise for this alternative may be ten months of construction in contrast to nearly 24 months for the Proposed Action

5.12.5.2 Post-Construction Effects

There would be no long-term adverse noise impacts as a result of the removal of the dam and installation of the ice control structure. Conversely, over the long-term, noise levels at the dam location would be reduced since there would no longer be the noise from the spillway structure itself.

5.12.5.3 Mitigation Measures

Mitigations measures would be the same as those discussed in the Proposed Action.

5.13 HUMAN HEALTH AND SAFETY, UTILITIES AND PUBLIC SERVICES, SOLID WASTE

5.13.1 Impact Criteria

Public health and safety includes potential impacts associated with construction-related health and safety risks. Utilities and public services include potential impacts on electricity, natural gas, water supplies, stormwater management, wastewater, solid waste, police, and fire services.

5.13.1.1 Human Health and Safety

The impact analysis for human health and safety evaluates how the alternatives would affect the health and safety of the general public and construction workers. The area of analysis includes the area in the immediate vicinity of the Ballville Dam, as well as the construction/demolition areas and staging areas.

The impacts on public health and safety would be significant if an alternative would physically interfere with an emergency evacuation plan or expose construction personnel or residents to a significant risk of loss, injury or death involving construction hazards.

5.13.1.2 Utilities and Public Services

This section addresses the impacts of the alternatives on utilities and public services including water supply in the project area during construction and long-term. The area of analysis for utilities and public services includes the areas where construction activities would occur, staging areas, and areas where the project has influence (i.e. new off channel reservoir intake).

Impacts on utilities and public services would be significant if the alternative would result in increased demand for utilities and public services that would exceed the capacity and outputs of existing utilities and services and require new or expanded utilities or services.

5.13.1.3 Solid Waste

This section addresses the impacts of the alternatives on the ability of local landfill facilities to accept non-hazardous debris materials that could not be disposed of at the dam site. The area of analysis for solid waste includes landfills and waste management facilities in Sandusky County.

Impacts on solid waste facilities would be significant if there is insufficient permitted capacity to accommodate the solid waste disposal needs at local landfills.

5.13.2 Proposed Action

5.13.2.1 Construction Effects

5.13.2.1.1 *Human Health and Safety*

The activities that would be undertaken for the Proposed Action could result in human health and safety risks. The movement of large construction vehicles and other equipment required for the dam removal activities and construction of the ICS present potential hazards to construction personnel; however, human health and safety risks to the general public are not expected due to the controlled environment. All contractors and their employees would be expected to follow a project safety plan to ensure their safety as well as the general public. Roadway safety would also be emphasized to all workers. Signage at the active construction site and upstream at the former transition zone between river and impoundment would indicate the hazard of lowered water levels and construction danger. Recreation in the impoundment area would be temporarily ceased until the project is safely completed approximately 24 months after first notch.

5.13.2.1.2 *Utilities and Public Services*

The dam removal activities and construction of the ICS could impact stormwater facilities and transmission lines. The construction vehicles would use local streets that would include stormwater facilities, including manholes, catch basins, drains, and sewers. In addition, the project area includes Ohio Power/American Electric Power (AEP) transmission lines. Impacts to these utilities would be mitigated through the implementation of mitigation measures detailed below.

Phases I and II would result in the loss of the former raw water intake as well as the Ballville dam impoundment, containing approximately 80 MG of water storage capacity. The off-channel raw water reservoir has been operational since February 2013 and currently provides the City of Fremont and their customers' water. The intake structure for the off channel reservoir was designed for water elevations based on dam removal. Average water elevation at the intake structure, after complete removal of the dam, is expected to be 618 feet (188.4 meters) AMSL (ARCADIS Intake Structure Structural Sections and Details Record Drawing 11-05-12). These plans also indicate a minimum water elevation of 615 feet (187.5 meters) AMSL; this is approximately 2.5 feet (0.8 meters) above the existing bedrock bottom and 4.5 feet (1.4 meters) above the bottom of the intake pipe (Section 14.13.2). Details from the Record Drawing indicate that the intake structure is at 610.5 feet (186.1 meters) AMSL and would have adequate water supply for withdrawal during the construction phase of the Proposed Action.

Another factor influencing water availability to the intake structure is the bed topography. Geotechnical exploration conducted approximately 550 feet (167.4 meters) upstream of the intake structure indicated that upon complete drawdown of the impoundment the Sandusky River thalweg (i.e. line of lowest elevation within a watercourse) would be tracking towards the west side of the channel and towards the intake. This data suggests the intake structure would continue to function as designed during Phases I and II.

There would be no impacts to schools, police or fire services, or other public services as a result of the construction activities.

5.13.2.1.3 *Solid Waste*

There are several landfills near the City of Fremont that accept concrete, rocks and stone, and other types of materials that may be hauled from the Ballville Dam site. It would be up to the contractor to determine where the material would be hauled. It is not anticipated that there would be a landfill capacity issue that would require additional landfill facilities to be developed.

5.13.2.2 Post-Construction Effects

5.13.2.2.1 *Human Health and Safety*

Upon completion of the Proposed Action, there would be significant positive impacts to human health and safety. Currently, the Ballville Dam is classified by the ODNR as a Class I structure, which is the highest hazard rating. This rating indicates that if the dam were to fail, there would be a probable loss of life downstream. Removal of the dam would eliminate liabilities of potential dam failure and loss of life. The dam presents a drowning hazard for boaters and swimmers. Low-head dams can be difficult to see from upstream and if a swimmer or boat goes over the dam and gets caught in the hydraulic pull along the toe of the dam it can submerge a person or vessel making it difficult to escape. The removal of the dam would eliminate this drowning hazard.

5.13.2.2.2 *Utilities and Public Services*

Completion of the Proposed Action would eliminate the estimated 80 MG water supply currently within the impoundment but not impact water availability or quality for the City of Fremont. There is a loss of water supply associated with the water directly impounded by the dam currently. However, an alternative off-channel reservoir was recently constructed to replace the impoundment at the Ballville Dam, which provided the City of Fremont’s raw water supply since 1959. The system utilized to draw water into the off channel reservoir requires water supply in the river as described in Section 4.13.2. This data indicates that removal of the dam was planned while constructing the intake structure and suggests that it would function as designed post dam removal.

ARCADIS (2008) modeled the performance of the off-channel reservoir and pumping system for current and future water demands for varied river flows including “near average” years and drought years. Model assumptions included:

- Water Usage:
    - “Current” Demands (2008): Average Daily Use = 3.9 MGD
    - “Future” Demands (2024): Average Daily Use = 9.1 MGD
        - This includes a projected average use for the Fremont Energy Center of 4 MGD
- Water Supply:
    - a minimum pumping rate of 3 MGD (4.65 cfs) and a maximum rate of 30 MGD (46.5 cfs),
    - pumping rates are limited to 90 percent of net stream flow available
    - net stream flow available is based on:
        - minimum required stream flow by of 8.2 MGD (12.7 cfs) throughout the year,
        - minimum flow of 209 MGD (323 cfs) maintained in river from April through June (with no withdrawals at night),
        - no June pumping due to assumed high nitrate elevations.
- Water Loss:
    - Estimates were made for evaporation, seepage and sedimentation.

Based on model results, Arcadis determined that following dam removal the off-channel storage facility and associated pumping station would provide sufficient capacity for existing and projected future water usage for the three worst drought years on record.

Based on the data presented in Section 4.13.2 and our analysis of the expected river form following removal, it is anticipated that the intake would be below grade and continue functioning as designed. However, due to the inherent importance of this structure to supply the regions raw water, mitigation measures have been developed which would be implemented if the intake structure is not able to draw water (section 5.13.2.3).

Therefore, no impacts to utilities or public services are expected over the long-term as a result of the removal of the dam.

5.13.2.2.3 *Solid Waste*

There would be no impacts to solid waste facilities over the long-term as a result of the Proposed Action.

5.13.2.3 Mitigation Measures

The following mitigation measures would be implemented to minimize impacts to human health and safety during construction:

- The Contractor shall be solely responsible for complying with all federal, state, and local safety requirements. Together with exercising precautions at all times for the protection of persons and property, it is also the sole responsibility of the contractor to initiate, maintain, and supervise all safety requirements, precautions, and programs in connection with the work.

- Construction workers would follow Occupational Safety and Health Administration (OSHA) regulations to reduce worker accidents during the dam removal and ICS construction activities.

- The contractor would be responsible for ensuring that construction vehicles enter and exit local roadways in a safe manner and, if necessary, provide flag persons in accordance with ODOT standards.

- Posting signage and erect fencing to exclude the public from construction areas.

The following mitigation measures would be implemented to minimize impacts to utilities during construction activities:

- Stormwater Facilities: Before any work is started on the project and again before the final acceptance by the owner, the Engineer and the contractor shall make an inspection of all existing sewers which are to remain in service and which may be affected by the work. The condition of existing conduits and their appurtenances shall be determined from field observations. The Engineer shall keep records of the inspection in writing.

  All existing manholes, catch basins, drains, sewers, and appurtenances inspected initially by the above-mentioned parities shall be maintained and left in a condition reasonably comparable to that determined by the original inspection. The contractor shall correct any change in the condition resulting from the contractor's operations to the satisfaction of the Engineer. The Contractor shall remove debris, silt, etc. from the existing manholes and catch basins that have been affected by construction operations. Service shall be maintained in the existing sewers throughout construction.

- Ohio Power/ American Electric Power (AEP) Transmission: The contractor shall contact AEP transmission's field representative a minimum of 48 hours prior to any construction activity in the vicinity of AEP's transmission lines.

  The contractor shall use extreme caution while working in the vicinity of the staging and access areas on or near AEP's property and transmission lines. The following construction practices shall be followed:

    - A low clearance zone should be maintained in the vicinity of overhead lines where boom or lift mechanisms may not be used.

    - No trees or shrubs shall be installed within ten feet on either side of overhead transmission.

- Modification of the river bed might be necessary near the raw water intake structure to maintain sufficient depth of flow over the structure during prolonged low water events. If required, this mitigation would consist of removing bedrock material to guide water to the intake. This would be done using heavy equipment and excavators to shape the bed to form a small channel that would direct water towards the intake in accordance with permitting requirements.

5.13.3 Alternative 1 – No Action Alternative

5.13.3.1 Construction Effects

5.13.3.1.1 *Human Health and Safety*

The activities that would be undertaken for this Action could result in human health and safety risks. The movement of construction vehicles and other equipment required for the dam rehabilitation activities present potential hazards to construction personnel; however, human health and safety risks to the general public are not expected due to the controlled environment. All contractors and their employees would be expected to follow a project safety plan to ensure their safety as well as the general public. Roadway safety would also be emphasized to all workers. Signage at the active construction site would indicate construction danger. Recreation downstream of the dam would be temporarily ceased until the project is safely completed.

Repairs to the concrete and sluicegates on the dam and the stabilization of the seawall would address the Notice of Violation from ODNR. However, rehabilitation of the Ballville Dam would not change the classification of the dam from a Class 1 dam. A Class 1 dam is the highest rating due to the probable loss of life if the dam were to fail during a flood event. The rehabilitation may allow for the dam to pass the Probable Maximum Flood (PMF), it would still cause significant flooding to the City if flows exceeded 50,000 cfs.

5.13.3.1.2 *Utilities and Public Services*

There would be no impacts to utilities or public services during the rehabilitation phase of the No Action Alternative. There are no utilities or pipelines in the vicinity of the Ballville Dam that would be impacted by the repair and maintenance activities. The former raw water intake infrastructure and carbon feed building could be maintained in the event that a separate water supply may be desirable in the future for the City. However, the current off-channel raw water reservoir is designed to meet current and future demands by the City. In addition, there would be no impacts to schools, police or fire services, or other public services as a result of the dam repair work to be completed to bring the dam into compliance with Ohio State Dam Safety Standards.

5.13.3.1.3 *Solid Waste*

There would be no impacts to solid waste facilities as a result of the No Action Alternative. Any debris that would be generated as a result of the repair and maintenance activities at the dam would be an insignificant amount and could be handled by existing landfills in the area.

5.13.3.2 Post-Construction Effects

5.13.3.2.1 *Human Health and Safety*

There would be no long-term changes to human health and safety as a result of the No Action Alternative. Risk of safety hazards to workers performing routine maintenance activities at the dam would exist; however, this risk would be considered slight and would be mitigated by ensuring that workers follow OSHA laws regarding protective equipment and procedures.

The dam would continue to be a Class 1 structure. Cyclical maintenance would help reduce the risk of failure but not eliminate those risks. Other liabilities include the continued presence of a drowning hazard for boaters and swimmers.

5.13.3.2.2 *Utilities and Public Services*

There would be no long-term changes to utilities and public services as a result of the No Action Alternative. Even after rehabilitation the dam would no longer be used as a raw water source for the city of Fremont. The new off-channel reservoir would continue to serve the City as its raw water source.

5.13.3.2.3 *Solid Waste*

There would be no long-term changes to solid waste as a result of the No Action Alternative.

5.13.3.3 Mitigation Measures

- The contractor shall be solely responsible for complying with all federal, state, and local safety requirements. Together with exercising precautions at all times for the protection of persons and property, it is also the sole responsibility of the contractor to initiate, maintain, and supervise all safety requirements, precautions, and programs in connection with the work.

- Construction workers and individuals working on the dam and fish elevator would follow Occupational Safety and Health Administration (OSHA) regulations to reduce worker accidents during the dam repair and maintenance activities

- The contractor would be responsible for ensuring that construction vehicles enter and exit local roadways in a safe manner and, if necessary, provide flag persons in accordance with ODOT standards

5.13.4 Alternative 2 – Rehabilitate Dam, Install Fish Passage Structure

5.13.4.1 Construction Effects

5.13.4.1.1 *Human Health and Safety*

These impacts would be the same as those described under Section 5.13.3.1. Additionally, under Alternative 2, there would be repair and maintenance actions and construction activities related to the installation of the fish elevator that could affect human health and safety. The movement of construction vehicles and other equipment required for the dam repair activities and building the fish elevator present potential hazards to construction personnel; however, human health and safety risks to the general public are not expected due to the controlled environment. All contractors and their employees would be expected to follow a project safety plan to ensure their safety as well as the general public. Roadway safety would also be emphasized to all workers. Signage at the active construction site would indicate construction danger. Recreation downstream of the dam would be temporarily ceased until the project is safely completed. These safety hazards would be reduced by the implementation of mitigation measures related to construction safety.

5.13.4.1.2 *Utilities and Public Services*

Alternative 2 would not impact utilities or public services. There are no utilities or pipelines in the vicinity of the Ballville Dam that would be impacted by the dam repair and maintenance activities or the installation of the fish elevator. There would be no utilities required to operate the fish lift since it would be a mechanical system. The former raw water supply infrastructure would most likely be removed to provide room for the fish elevator tail race and attraction system. Impacts to the City's raw water source are not expected as the City currently has in operation a 730 MG off-channel reservoir approximately 6,000 ft. upstream of the Ballville Dam. In addition, there would be no impacts to schools, police or fire services, or other public services as a result of the dam rehabilitation work to be completed to bring the dam into compliance with Ohio State Dam Safety Standards.

5.13.4.1.3 *Solid Waste*

There would be no impacts to solid waste facilities as a result of Alternative 2. Any debris that would be generated as a result of the repair and maintenance activities at the dam or the installation of the fish ladder would be an insignificant amount and could be handled by existing landfills in the area.

5.13.4.2 Post-Construction Effects

5.13.4.2.1 *Human Health and Safety*

During the operation of Alternative 2, there would be no long-term impacts to human health and safety. While there is always the risk of safety hazards to workers performing routine maintenance activities at the dam and fish elevator, this risk would be considered slight and would be mitigated by ensuring that workers follow OSHA laws regarding protective equipment and procedures.

The dam would continue to be a Class 1 structure. Cyclical maintenance would help reduce the risk of failure but not eliminate those risks. Other liabilities include the continued presence of a drowning hazard for boaters and swimmers.

5.13.4.2.2 *Utilities and Public Services*

During the operation of Alternative 2, there would be no long-term impacts to utilities and public services.

5.13.4.2.3 *Solid Waste*

During the operation of Alternative 2, there would be no long-term impacts to solid waste facilities.

5.13.4.3 Mitigation Measures

The following measures would be undertaken to mitigate potential impacts related to the construction and operation of Alternative 2 - Rehabilitate Dam, Install Fish Passage Structure:

- The contractor shall be solely responsible for complying with all federal, state, and local safety requirements. Together with exercising precautions at all times for the protection of persons and property, it is also the sole responsibility of the contractor to initiate, maintain, and supervise all safety requirements, precautions, and programs in connection with the work.
- Construction workers and individuals working on the dam and fish elevator would follow Occupational Safety and Health Administration (OSHA) regulations to reduce worker accidents during the dam repair and maintenance activities
- The contractor would be responsible for ensuring that construction vehicles enter and exit local roadways in a safe manner and, if necessary, provide flag persons in accordance with ODOT standards

5.13.5 Alternative 3 – Dam Removal with Ice Control Structure

5.13.5.1 Construction Effects

5.13.5.1.1 *Human Health and Safety*

The effects to Human Health and Safety for Alternative 3 are the same as those described in Section 5.13.2.1.1. However these effects are expected to only exist for the duration of the shortened construction period associated with this Alternative—approximately ten months. Recreation in the impoundment area would be temporarily ceased until the construction is safely completed approximately ten months after first notch.

5.13.5.1.2 *Utilities and Public Services*

The effects to Utilities and Public Services for Alternative 3 are the same as those described in Section 5.13.2.1.2.

5.13.5.1.3 *Solid Waste*

The effects to Solid Waste for Alternative 3 are the same as those described in Section 5.13.2.1.3.

5.13.5.2 Post-construction Effects

5.13.5.2.1 *Human Health and Safety*

The effects to Human Health and Safety for Alternative 3 are the same as those described in Section 5.13.2.2.1.

5.13.5.2.2 *Utilities and Public Services*

The effects to Utilities and Public Services for Alternative 3 are the same as those described in Section 5.13.2.2.2.

5.13.5.2.3 *Solid Waste*

There would be no impacts to solid waste facilities over the long-term as a result of this alternative.

5.13.5.3 Mitigation Measures

Mitigation measures for Alternative 3 are the same as those described in Section 5.13.2.2.3.

5.14 CUMULATIVE EFFECTS

The CEQ defines cumulative effects as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (40 CFR 1508.7). In 1997, the CEQ published *Considering Cumulative Effects under the National Environmental Policy Act* as a comprehensive guidance document for cumulative analyses. The CEQ guidelines acknowledge that while “in a broad sense all the impacts on affected resources are probably cumulative,” it is important to “count what counts” and narrow the focus of the analysis to important national, regional, and local issues. While the CEQ recommends this be done through scoping, they also caution that “not all potential cumulative effects issues identified during scoping need to be included” in an EIS, but only those effects with direct influence on the Project and Project decision-making.

This section analyzes the cumulative effects on each of the specific resources discussed in Sections 5.1 to 5.14, and provides an overall, synergistic analysis of the cumulative effects of the Proposed Action, other action alternatives and past, current, and reasonably foreseeable actions in the region surrounding the Project. Reasonably foreseeable actions are future actions that have been proposed. The geographic scope of this cumulative effects analysis varies for each resource depending on the spatial extent of potential cumulative impacts. The temporal scope of the cumulative analysis extends approximately 30 years into the future.

5.14.1 Methodology for Cumulative Effects Analysis

The 1997 CEQ guidelines recommend analyzing cumulative effects according to a tiered approach among specific resources, interconnected systems, and human communities. This hierarchical approach allows for a quantitative, resource-specific analysis as well as a synergistic and additive discussion of the system-level influence of regional actions. As per the CEQ guidelines, resources that would not be impacted by the Proposed Action or action alternatives, have beneficial effects, or are only subject to temporary effects were excluded from this analysis (CEQ 1997). The No Action Alternative would not result in cumulative impacts to any resource since there would be no change in the existing conditions and so is not included in the cumulative effects analysis. Table 5-7 summarizes the screening process to determine the resources included in the cumulative effects analysis.

Table 5-7. Summary table of potential effects considered for cumulative effects analysis

Resource	Potential Long Term Adverse Effect of the Proposed Action and/or Action Alternatives Possible?	Potential Effect	Cumulative Effects Analysis Required?	Analysis Area
Physiography, Geology, and Soils	No	Transport of sediment currently impounded is expected to move through the system within a few years of project completion with no long term impacts beyond the current sediment loading in the Sandusky River Watershed.	No	NA
Water Resources	**Yes**	**Project would result in loss of 54 acres of wetlands and a gain of 23-55 acres of wetlands that were formerly inundated. Wetland gains are uncertain and dependent on sediment mobilization and stream flows during and after dam removal. Adverse effects to streams are temporary and minor, with long term beneficial effects. There is no effect on groundwater. Water quality will improve over the long term, leading to attainment of Aquatic Life Use designation.**	**Yes**	**Segment of the Sandusky River that extends from the Bacon Low Head Dam in Tiffin, Ohio and into Sandusky Bay**
Rare, Threatened, and Endangered Species	No	Project would have only temporary minor adverse impact relating to sediment transport during and post construction, diminishing in out years. Long-term effects are beneficial.	No	NA
Wildlife and Fisheries	No	Project would have only temporary minor adverse impact relating to sediment transport during and post construction, diminishing in out years. Long-term effects are beneficial.	No	NA

Table 5-7. Summary table of potential effects considered for cumulative effects analysis

Resource	Potential Long Term Adverse Effect of the Proposed Action and/or Action Alternatives Possible?	Potential Effect	Cumulative Effects Analysis Required?	Analysis Area
Land Use	No	Project would have mostly temporary impacts to a small amount of upland forest. Open water areas of the former impoundment will be changed to vegetated riparian areas, however the land use will be similar. No significant effect.	No	NA
Recreation	No	Project would change the impoundment/lake setting to a river setting, however recreational opportunities such as fishing, boating, hiking, picnicking, etc. would be maintained. Temporary, short-term impacts due to closure of project area during construction. No significant effect.	No	NA
Socioeconomics and Environmental Justice	No	No significant effect.	No	NA
Cultural and Historic Resources	**Yes**	**Project would have adverse effect on a historic property.**	**Yes**	**Cultural Resources APE**
Visual Resources	**Yes**	**Dam removal and placement of ICS would be a permanent alteration within the viewshed.**	**Yes**	**Viewshed of Current Dam site**
Transportation and Traffic	No	Project would have only temporary minor adverse impact to local roads during construction.	No	NA
Air Quality	No	Project would have only temporary minor adverse impact to local air quality during construction.	No	NA
Noise	No	Project would have only temporary minor adverse impact to properties within 3,200 feet of Project Area during construction.	No	NA

Table 5-7. Summary table of potential effects considered for cumulative effects analysis

Resource	Potential Long Term Adverse Effect of the Proposed Action and/or Action Alternatives Possible?	Potential Effect	Cumulative Effects Analysis Required?	Analysis Area
Human Health and Safety, Utilities	No	No significant effect.	No	NA

5.14.2 Reasonably Foreseeable Actions That Could Contribute to Cumulative Effects

Much of the Action Area and surrounding vicinity is either the Sandusky River itself, or zoned as commercial or residential, with some agricultural sections. Major actions which have changed the landscape within the vicinity of the Action Area include: the creation of the channelized section of river downstream; the construction of the water intakes and reservoir system; the construction and maintenance of roadways and bridges; and the development of parks and a golf course along the river.

For the reasonably foreseeable future, development in the Action Area is expected to be limited to residential and small scale commercial development. Additionally, local work may include creating new access points to the river to accommodate increased recreation, modifying and maintaining existing infrastructure such as roadways and bridges, and making minor alterations in nearby residential vegetation management or agriculture.

Accordingly, reasonably foreseeable actions that could contribute to cumulative effects include:

- Road or bridge maintenance and building projects;
- Small scale residential and business developments within the Action Area and adjacent lands;
- Increased recreational use of the Sandusky River in the area;
- Vegetation management including tree trimming/clearing, mowing, and agricultural practices.

5.14.3 Water Resources

5.14.3.1 Proposed Action – Incremental Dam Removal with Ice Control Structures

The cumulative effects analysis of water resources focuses on wetlands within the Action Area. The Proposed Action would represent a loss of 54 acres (21.8 hectares) of wetlands and a gain of 23-55 acres (9.3 – 22.3 hectares) of wetlands that were part of the former impoundment. Wetland gains are uncertain and dependent on sediment mobilization and stream flows during and after dam removal.

Past activities that affected wetlands within the project area include creation of the Ballville Dam and associated infrastructure, residential and commercial development along the banks of the Sandusky River where seasonal wetlands likely historically existed, and draining of wetlands for agricultural production.

Past human activities that have impacted water resources include agricultural practices, road maintenance practices, and residential and commercial development. Agricultural practices, such as clearing, draining, and filling, have had significant impacts on water resources since the days of early settlement in Ohio. During the early settlement period, common agricultural practice included draining swamps, and since 1850 approximately 90 percent of Ohio's wetlands have been converted to other uses (Brown and Ward not dated). Impacts to water resources from these activities may have included erosion and sedimentation, similar to what is expected from the Project. The greatest source of past water quality impacts in the Project vicinity is from agricultural practices.

Reasonably foreseeable future actions in the Action Area that may impact water resources include road maintenance projects, continued agricultural use, development of residences and small businesses, and the future disposition of wetland vegetation on private property bordering the river within the action area. No major land developments are currently proposed in the Action Area. If a major development were to be proposed it would be subject to local, state, and possibly federal review, and would be required to comply with the USACE regulations pertaining to impacts to wetlands and streams and Ohio's EPA rules for minimizing impacts to water resources. Any cumulative effects to water resources from the combination of the Proposed Action with past, present, and reasonably foreseeable future actions would be minor because the state and/or federal permitting process(es) would require avoidance, minimization, and mitigation (in some cases) of impacts.

5.14.3.2 Alternative 2 – Fish Passage Structure

Construction of a fish passage structure would have only insignificant impacts to surface water resources. As such, there would be no cumulative effects on water resources from Alternative 2.

5.14.3.3 Alternative 3 – Dam Removal with Ice Control Structures

Alternative 3 differs from the Proposed Action with respect to the timeline for removal. The operational differences to carry out this alternative would not affect water resources. As such, the cumulative effects on water resources of Alternative 3 would not differ from those of the Proposed Action.

5.14.4 Cultural and Historic Resources

5.14.4.1 Proposed Action – Incremental Dam Removal with Ice Control Structures

The cumulative effects analysis of cultural resources focuses on impacts of the Proposed Action and action alternatives, specifically the removal of Ballville Dam, as defined in Section 5.8. Past actions within the APE include, but are not limited to, the construction of the Ballville Dam and associated infrastructure, the development of residential and commercial buildings, the development of roads and bridges, the placement of cemeteries, and the use of agriculture practices.

As indicated in Sections 5.8 of this FEIS, the Proposed Action would have an adverse effect on the historic Ballville Dam and mitigation measures are presented in the Final Programmatic Agreement (Appendix D1) that would address these effects to the extent practicable. This includes the possibility of the presence of Tucker Dam within the current impoundment and its assessment once the site is exposed. Completion of the Proposed Action would result in complete removal of the Ballville Dam and Tucker Dam if present. However, the Hydroelectric

Plant and the Jacob King Farmhouse, both eligible for the National Register of Historic Places, would remain in the APE after construction is completed.

Other reasonably foreseeable projects that could affect historic properties in the APE include road maintenance projects or development of residences and small businesses. No major land developments are currently proposed in the Action Area. If a major development were to be proposed it would be subject to local, state, and possibly federal review, and would be required to comply with the required permits. As such, beyond the initial adverse effect to the Ballville Dam, the relatively minimal effects of past projects in the APE on historic and cultural resources and reasonably foreseeable future actions, when combined with the effects disclosed for the Proposed Action, would produce minor cumulative impacts to historic resources.

5.14.4.2 Alternative 2 – Fish Passage Structure

Archaeological surveys indicated that no cultural resources are within the proposed footprint of the fish passage structure (ACS 2011). Therefore, this action would not impact cultural resources. As such, there would be no cumulative effects on cultural resources from Alternative 2.

5.14.4.3 Alternative 3 – Dam Removal with Ice Control Structures

Alternative 3 differs from the Proposed Action with respect to the timeline for removal. The operational differences would not affect cultural resources. As such, the cumulative effects on cultural resources of Alternative 3 would not differ from those of the Proposed Action.

5.14.5 Visual Resources

5.14.5.1 Proposed Action – Incremental Dam Removal with Ice Control Structures

The cumulative effects analysis of visual resources focused on the regional impacts of the Proposed Action and alternatives, specifically within the viewshed of the Project site and ICS.

The removal of the dam and the placement of the ICS described in the Proposed Action would directly and permanently impact visual resources for nearby residents and visitors to the site. The impounded section of the river would revert to riverine habitat, the dam itself would be removed and the ICS would be constructed immediately downstream of the current dam site. However, aside from the Proposed Action there are no reasonably foreseeable projects within the viewshed that would have additional adverse effects on visual resources, so cumulative effects are expected to be minor.

5.14.5.2 Alternative 2 – Fish Passage Structure

Construction of a fish passage structure would minimally impact visual resources with the additional structure attached to the dam. These impacts are insignificant, therefore there would be no cumulative effects on visual resources from Alternative 2.

5.14.5.3 Alternative 3 – Dam Removal with Ice Control Structures

Alternative 3 differs from the Proposed Action with respect to the timeline for removal. The operational differences would not affect visual resources. As such, the cumulative effects on visual resources of Alternative 3 would not differ from those of the Proposed Action.

6.0 Comparison of Alternatives

NEPA (40 CFR 1501) and Service guidelines (550 FW 2.6) require that an EIS include a discussion and comparison of the effects of the Proposed Action and alternatives, including reasonable mitigation measures identified during the EIS development. Chapter 3 of this FEIS describes the alternatives, and the resource-specific sections of Chapter 5 describe the effects and reasonable minimization, avoidance, and mitigation measures. This chapter compares the impacts of the Proposed Action and alternatives and their potential mitigation measures.

6.1 EFFECTS SUMMARY

Four alternatives were carried forward for analysis in the FEIS: the Proposed Action – Incremental Dam Removal with Ice Control Structure, Alternative 1 – No Action, Alternative 2 – Fish Passage Structure, and Alternative 3 – Dam Removal with Ice Control Structure. Each Alternative is differentiated from one another by various methods of achieving the purpose and need of the project, resulting in different levels of success balanced with the impact of those actions. The Proposed Action meets all of the purposes and needs for the project while working to minimize sediment impacts downstream. The No Action Alternative would result in no significant change to the identified resources because the Dam would be rehabilitated and remain in place. Table 6-1 compares the anticipated impacts of the Proposed Action with Alternatives 1-3 as defined above and in Chapter 3. Specific impacts and mitigation measures that address some or all of those anticipated impacts are described in Chapter 5 and summarized in Table 6-2.

Table 6-1. Comparison of Anticipated Impacts for Each Alternative

Resource	Proposed Action – Incremental Dam Removal with Ice Control Structure	Alternative 1 – No Action	Alternative 2 – Fish Passage Structure	Alternative 3 – Dam Removal with Ice Control Structure
5.1 – Physiography, Geology, and Soils	Release of sediments currently within the impoundment during the 24 month incremental removal and movement of those sediments downstream over time; stabilization of approximately 20 acres of previously inundated sediment; clearing of south work pad and use of clean fill for access roads and work pad.	Temporary impacts related to release of small amounts of sediment from impoundment due to rehabilitation and future sluice gate operations	Temporary impacts related to release of small amounts of sediment from impoundment due to rehabilitation, construction of fish passage structure and future sluice gate operations	Release of sediments currently within the impoundment during single phase 10 month removal and movement of those sediments downstream over time; potential to export a larger quantity of sediment immediately following the removal of the dam creating larger immediate negative impacts

Table 6-1. Comparison of Anticipated Impacts for Each Alternative

Resource	Proposed Action – Incremental Dam Removal with Ice Control Structure	Alternative 1 – No Action	Alternative 2 – Fish Passage Structure	Alternative 3 – Dam Removal with Ice Control Structure
5.2 - Water Resources	Temporary sediment suspension within the water column during pool drawdown over 2 years; minor aggradation of sediment downstream; hydrologic alteration to 54 acres of wetlands; direct impacts including fill and channel restoration to 0.67 acres of wetland; Anticipated gains in wetlands upstream of the dam ranging from 23-55 acres; permanent improvements in water quality within the former dam pool reach; permanent improvements in natural riverine sediment transport processes. Placement of 28,000 CY of fill in and along approximately 866 linear feet of the Sandusky River, covering 4.38 acres for river bank shaping.	Temporary localized sedimentation for a short distance above and below the dam expected during rehabilitation and future sluice gate operations	Temporary localized sedimentation for a short distance above and below the dam expected during rehabilitation, fish passage construction, and future sluice gate operations	Sediment suspension within the water column during the 10 month period; minor aggradation of sediment downstream; hydrologic alteration to 54 acres of wetlands; direct impacts including fill and channel restoration to 0.67 acres of wetland; Anticipated gains in wetlands upstream of the dam ranging from 23-55 acres; permanent improvements in water quality within the former dam pool reach; permanent improvements in natural riverine sediment transport processes. Placement of 28,000 CY of fill in and along approximately 866 linear feet of the Sandusky River, covering 4.38 acres for river bank shaping.

Table 6-1. Comparison of Anticipated Impacts for Each Alternative

Resource	Proposed Action – Incremental Dam Removal with Ice Control Structure	Alternative 1 – No Action	Alternative 2 – Fish Passage Structure	Alternative 3 – Dam Removal with Ice Control Structure
5.3 - Wildlife and Fisheries	Temporary displacement of fish and wildlife and habitat degradation during the 24 month construction time period and while impounded sediment is moved downstream; long term aquatic habitat improvements from the area returning to a free flowing river ecosystem are expected including reopening approximately 22 miles of aquatic habitat to migratory fish species; improved fish and aquatic invertebrate community upstream of the former dam	Temporary, minor displacement of fish and wildlife, and habitat degradation expected during rehabilitation and possibly during annual sluice gate operations, continued long term negative impact on species in the area from presence of the dam	Temporary, minor displacement of fish and wildlife, and habitat degradation expected during rehabilitation and possibly during annual sluice gate operations, likely continued long term negative impact on species in the area from presence of the dam; uncertain if fish passage structure would have benefits to some species	Temporary displacement of fish and wildlife and habitat degradation during the 10 month time period and while impounded sediment is moved downstream are expected to be more severe than the under the Proposed Action; long term aquatic habitat improvements from the area returning to a free flowing river ecosystem are expected including reopening approximately 22 miles of aquatic habitat to migratory fish species; improved fish and aquatic invertebrate community upstream of the former dam

Table 6-1. Comparison of Anticipated Impacts for Each Alternative

Resource	Proposed Action – Incremental Dam Removal with Ice Control Structure	Alternative 1 – No Action	Alternative 2 – Fish Passage Structure	Alternative 3 – Dam Removal with Ice Control Structure
5.4 – Rare Threatened and Endangered Species	Loss of up to 0.5 acres of forest habitat that may be suitable for Indiana Bat and Northern long-eared Bat due to workpad and north access road construction, but no adverse effects anticipated; temporary habitat degradation, displacement of Threehorn Wartyback and Greater Redhorse due to the release of impounded sediments; long term positive impacts for aquatic state listed species in the area are expected due to habitat restoration	Temporary displacement and habitat degradation possible during rehabilitation and during annual sluice gate operations, continued long term negative impact on species in the area from presence of the dam	Temporary displacement and habitat degradation possible during rehabilitation and during annual sluice gate operations, likely continued long term negative impact on species in the area from presence of the dam	Loss of up to 0.25 acres of forest habitat that may be suitable for Indiana Bat and Northern long-eared Bat, but no adverse effects anticipated ; more severe but shorter-term impacts from temporary habitat degradation, displacement of Threehorn Wartyback and Greater Redhorse compared to the proposed action due to the quicker release of impounded sediments; long term positive impacts for aquatic state listed species in the area are expected due to habitat restoration
5.5 – Land Use	0.69 acre of land clearing to develop both south and north access roads expected during periods of construction activity in the vicinity compatible with local land use, zoning, and planned development; alterations to current land use in impoundment as the former inundated area reverts to deciduous forest or grassland/herbaceous areas	No impacts expected during rehabilitation	No impacts expected during rehabilitation or fish passage structure construction	0.55 ac of land clearing to develop north access road expected during periods of construction activity in the vicinity compatible with local land use, zoning, and planned development; alterations to current land use in impoundment as the former inundated area reverts to deciduous forest or grassland/herbaceous areas

Table 6-1. Comparison of Anticipated Impacts for Each Alternative

Resource	Proposed Action – Incremental Dam Removal with Ice Control Structure	Alternative 1 – No Action	Alternative 2 – Fish Passage Structure	Alternative 3 – Dam Removal with Ice Control Structure
5.6 - Recreation	Temporary (approximately 24 months) reduction in recreational opportunities such as boating and fishing in and around the dam and impoundment area; temporary impact to Portage Trail Park restricting downstream access during construction and restoration; potential to temporarily impact River Cliff Golf Course due to possible aggradation as sediment is moved downstream	Temporary reduction in recreational opportunities immediately adjacent to dam during rehabilitation	Temporary reduction in recreational opportunities immediately adjacent to dam during rehabilitation or construction of fish passage structure	Temporary (approximately 10 months) reduction in recreational opportunities such as boating and fishing in and around the dam and impoundment area; temporary impact to Portage Trail Park restricting downstream access during construction and restoration; potential to temporary impact to River Cliff Golf Course due to possible aggradation as sediment is moved downstream
5.7 – Socioeconomics and Environmental Justice	Temporary (approximately 24 months) positive impacts on employment and construction related business in the area; Long term positive impacts on local business community, also possible uncertain long term impacts, either positive or negative, on water front property values; dependent on individual property deeds property taxes may increase for private landowners whose property expands as a result of the action.	Temporary positive impacts on employment and construction related business in the area during rehabilitation; potential long term adverse impacts to local businesses related to continued degradation of aquatic habitat and the recreational fishery downstream of the dam	Temporary positive impacts on employment and construction related business in the area during rehabilitation and fish passage structure construction and operation; long term impacts are unclear and dependent on successful establishment of migratory fish populations upstream of Ballville Dam	Temporary (approximately 10 months) positive impacts on employment and related business in the area; Long term positive impacts on local business community, also possible uncertain long term impacts, either positive or negative, on water front property values; dependent on individual property deeds property taxes may increase for private landowners whose property expands as a result of the action.

Table 6-1. Comparison of Anticipated Impacts for Each Alternative

Resource	Proposed Action – Incremental Dam Removal with Ice Control Structure	Alternative 1 – No Action	Alternative 2 – Fish Passage Structure	Alternative 3 – Dam Removal with Ice Control Structure
5.8 – Cultural and Historic Resources	Removal of Ballville Dam represents an adverse effect on its listing potential under the National Historic Preservation Act; removal of Tucker Dam, if present, is to be evaluated as appropriate during construction period	No impacts to listing potential for Ballville Dam under the National Historic Preservation Act	No impacts to listing potential for Ballville Dam under the National Historic Preservation Act	Removal of Ballville Dam represents an adverse effect on its listing potential under the National Historic Preservation Act; removal of Tucker Dam, if present, is to be evaluated as appropriate during construction period
5.9 – Visual Resources	Temporary impacts (approximately 24 months) to community members in the vicinity expected during construction relating to the notching of the dam, the construction of the ICS, and removal of the dam; long term visual impacts related to the construction of ICS and change from impoundment to free flowing river	Temporary, minor impacts to nearby residents expected during rehabilitation	Temporary, minor impacts to nearby residents expected during rehabilitation; long term impacts relating to the construction of the fish passage structure are not expected	Temporary impacts (approximately 10 months) to community members in the vicinity expected during construction relating to the notching of the dam, the construction of the ICS, and removal of the dam; long term visual impacts related to the construction of ICS and change from impoundment to free flowing river
5.10 – Transportation and Traffic	Temporary increases in local traffic for approximately 24 months with the heaviest impacts during periods of activity at the site, expected during construction as vehicles with equipment or debris enter and exit the area; no long term impacts are expected	No impacts expected during rehabilitation	No impacts expected during rehabilitation or fish passage structure construction	Temporary increases in local traffic for approximately 10 months with a more truncated but therefore more intense series of impacts than the Proposed Action expected during construction as vehicles with equipment or debris enter and exit the area; no long term impacts are expected

Table 6-1. Comparison of Anticipated Impacts for Each Alternative

Resource	Proposed Action – Incremental Dam Removal with Ice Control Structure	Alternative 1 – No Action	Alternative 2 – Fish Passage Structure	Alternative 3 – Dam Removal with Ice Control Structure
5.11 - Air Quality	Temporary, localized impacts (approximately 24 months) expected from increases in emissions and fugitive dust in construction areas	Temporary, localized impacts expected as minor increases in emissions and fugitive dust during rehabilitation	Temporary, localized impacts expected as minor increases in emissions and fugitive dust during rehabilitation and fish passage structure construction	Temporary, localized impacts (approximately 10 months), with a more truncated but therefore more intense series of impacts than the Proposed Action expected, from increases in emissions and fugitive dust in construction areas
5.12 - Noise	Temporary (approximately 24 months) increases in noise expected at many noise receptors within 3,200 ft. of the project during periods of construction activity with impacts most significant at receptors closest to the dam; long term impact would be the elimination of noise associated with water cresting the spillway on Ballville Dam	Temporary increases in noise expected at noise receptors within 1,600 ft. during periods of rehabilitation activity; There are no long term changes to the existing noise environment	Temporary increases in noise expected at noise receptors within 1,600 ft. during rehabilitation and fish passage structure construction; There are no long term changes to the existing noise environment	Temporary (approximately 10 months) increases in noise expected at many noise receptors within 3,200 ft. of the project during periods of construction activity with impacts most significant at receptors closest to the dam; long term impact would be the elimination of noise associated with water cresting the spillway on Ballville Dam
5.13 - Human Health and Safety, Utilities and Public Services, Solid Waste	Temporary (approximately 24 months) increased risk to health and human safety associated with construction activity; No long term impacts expected.	Temporary increased risk to health and human safety associated with rehabilitation activity; dam would continue to be a Class 1 structure; cyclical maintenance would reduce risk of failure.	Temporary increased risk to health and human safety associated with during rehabilitation and fish passage structure construction; dam would continue to be a Class 1 structure; cyclical maintenance would reduce risk of failure.	Temporary (approximately 10 months) increased risk to health and human safety associated with construction activity; No long term impacts expected.

Table 6-2. Mitigation Measures

Resource	Avoidance, Minimization, and Mitigation Measures
5.1 – Physiography, Geology, and Soils	Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects such as soil erosion, resulting from construction. Erosion control and storm water management would be required during construction through the National Pollutant Discharge Elimination System (NPDES) permitting program.
	Seeding the formerly inundated impoundment following the initial dam notch would help stabilize the sediments and minimize eroding banks and downstream impacts.
5.2 - Water Resources	Best Management Practices (BMPs) and acceptable design and construction procedures would be used to reduce or eliminate anticipated undesirable effects such as soil erosion, resulting from construction that could contribute to sediment deposition. Erosion control and storm water management is required during construction through the National Pollutant Discharge Elimination System (NPDES) permitting program.
	All terms and conditions of USACE and OEPA permits will be followed.
	Any wetlands that form on property owned by the City of Fremont would be placed in a conservation easement and permanently protected. At this time modeling indicates that the City owns 13.2 acres where wetlands could potentially form.
	Clean rubble from demolition will be maintained onsite to potentially be used for adaptive actions such as shaping the floodplain topography to promote the formation of fringe wetlands and/or floodplain wetlands, addressing rilling or gully formation on exposed sediments upstream of the dam, or other actions to address erosion or habitat enhancements as upstream river conditions change.
	The City would collaborate with willing landowners to implement seeding and planting on newly established wetlands, consistent with the Planting Plan (Appendix A6) on these properties similar to those undertaken on City owned property. If private landowners are willing, these newly established wetlands would be placed in permanent conservation easements as well.
	Fill for temporary roads would be removed and the area restored to previous condition. Some fill may be retained for additional grading.
	Seeding the formerly inundated impoundment following the initial dam notch with native wetland vegetation would help stabilize the sediments and aid in minimizing wetland loss impacts to local wildlife.
	Impacts to the lower Sandusky River and Lake Erie would be minimized through the timing of the demolition. Specifically, demolition activities expected to release sediment into the river would be carried out at the beginning of the wet season, anticipating sufficient flow rate to assist with sediment transport; and when ambient concentrations are already high to reduce the likelihood of an abrupt environmental change or shock to the lower river.

Table 6-2. Mitigation Measures

	A letter of map revision (LOMR) would be provided to the Federal Emergency Management Agency (FEMA) to amend their flood mapping resources.
	Should the new reservoir intake not have sufficient flows once the dam is removed and impoundment is drawn down, a pilot channel (215 linear feet [65.5 meters], 0.04 acres [0.02 hectares]) would be excavated from the Sandusky River (Figure 5-2) so that flow reaches the reservoir intake.
	Long term improvements to surface water quality from dam removal will result from the project and will be documented through increases in QHEI, fish IBI, and macroinvertebrate ICI scores and attainment of Aquatic Life Uses. These improvements will offset temporary impacts from increased sediment load.
5.3 - Wildlife and Fisheries	The incremental approach was designed to result in the release of smaller volumes of sediment over a longer time frame. This is expected to minimize the size of the sediment wedge and the magnitude of suspended sediment to minimize potential impacts to aquatic species inhabiting areas downstream of the dam.
	Demolition would be sequenced to occur in the fall, just before the onset of the wet season. This strategy would minimize the potential for physiological stress and mortality in aquatic organisms by restricting demolition to periods when stream temperatures would be low and metabolic demand would also be low.
	Existing roads would be used to the maximum extent practicable. Any improvements that require tree cutting would adhere to seasonal restrictions (between October 1 and April 1) whenever possible to ensure that direct impacts to bats are avoided. Additionally, these dates are the most likely to ensure no direct impacts to wildlife.
	Native live mussels located on the exposed ban/margins of the former impoundment during drawdown would be recovered and relocated to suitable habitat in the Sandusky River upstream of the dam as quickly as possible. This activity would be coordinated with ODNR and the Service to ensure appropriate level of effort and effectiveness.
	Colonization of upstream reaches by aquatic invasive species may take years or decades, post project aquatic resource monitoring would assist in understanding what species are moving through the area and utilizing the aquatic habitat.
	A pre- and post-project monitoring plan is in place for aquatic populations utilizing the lower Sandusky river.
5.4 – Rare, Threatened, and Endangered Species	Existing roads would be used to the maximum extent practicable to minimize impacts to forest and shrub habitat that may support Indiana bat or Kirtland’s Warbler.
	No tree clearing would occur within 660 feet of the bald eagle nest or within any woodlot supporting a nest tree. Further, any work within 660 feet of a nest or within the direct line-of-site of a nest be restricted from January 15 through July 31. This would prevent disturbance of the eagles from the egg-laying period until the young fledge.

Table 6-2. Mitigation Measures

	The use of incremental removal is intended to diminish the initial delivery of sediment to downstream reaches. Seeding of exposed sediments is also designed to restrict the export of stored sediment in the impoundment. By releasing smaller volumes of sediment over a longer time frame, adverse effects for aquatic habitats and species would be minimized.
	Improvements that require tree cutting would adhere to seasonal restrictions (no tree clearing between April 1 and October 1) to ensure that direct impacts to Indiana bats, Northern long-eared bat, and Kirtland's warbler are avoided when possible. Clearing of the south work pad would occur in prior to the October 1 date. If clearing between April 1-September 30, 2015 is proposed, surveys would occur to document presence or likely absence of protected bats.
	In-stream work would be avoided during key spawning periods.
	Native live mussels located on the exposed ban/margins of the former impoundment would be recovered and relocated to suitable habitat in the Sandusky River upstream of the dam.
	Demolition of the dam in the fall when water temperatures would be lower (and oxygen concentrations higher) to minimize physiological stress in state listed fish that might occur as a result of higher suspended sediment concentrations.
	A pre- and post-project monitoring plan is in place for aquatic populations utilizing the lower Sandusky river.
5.5 – Land Use	Restoring access roads after construction is complete by reseeding and subsoil decompaction and overly compacted areas; repairing all inadvertently damaged tile lines through the south agricultural fields; stabilizing newly exposed sediment in the former impoundment with seed or mulch.
5.6 – Recreation	Communication of river closure and access would be provided by the City of Fremont to ensure safe recreation for all resource users.
	Signs would be posted upstream of the ICS warning recreational boaters that the structure may present a water hazard at certain flows.
5.7 – Socioeconomics and Environmental Justice	To determine the impacts to boundaries of private property along the Sandusky River, a survey of the bordering property owners within the affected impoundment would be completed during the design phase of the project. Surveys would occur within five years after project completion. This would provide a reasonable time period for the Sandusky River to realize its new course.
5.8 – Cultural and Historic Resources	In accordance with Section 106, the Service has completed Section 106 consultation to identify measures to avoid, minimize, or mitigate the adverse effects of the proposed project on the Ballville Dam. The Service and the Consulting Parties, with input from the Interested Parties, have signed a Programmatic Agreement (PA) to address mitigation of adverse impacts to the Ballville Dam and, as needed, the Tucker Dam (Appendix D1).

Table 6-2. Mitigation Measures

	A detailed inventory of dams in Ohio contained in the comprehensive list maintained by the ODNR, constructed between 1880 and 1930, less than 50 feet tall and less than 800 feet long would be completed as per the PA to mitigate for Criterion A
	Additionally, the consulting parties would complete a recordation comparable to the Historic American Buildings Survey / Historic American Engineering Record (HABS/HAER). Minimally, work would consist of a heightened visual recordation of the Ballville Dam before and during demolition and would include close-up photographs and line drawings, as needed, to document the dam's internal construction.
	Mitigation for Tucker Dam would be addressed as needed and would follow the guidelines laid out in the PA
5.9 – Visual Resources	The Ice Control Structure final design would take into consideration the use of materials that allow for the piers to blend in with their surroundings in order to lessen their visibility. Additionally, periodic debris removal would occur in order to avoid unsightly debris dams.
	The Sandusky River is a State designated Scenic River, dam removal is consistent with the program priorities established by the ODNR Scenic Rivers Program, which include the following: protect riparian buffer and stream habitat; dam removal; and watershed planning.
	Immediate seeding and planting of exposed sediment in the former impoundment area will limit the view of bare ground or mudflats to a minimal amount of time.
5.10 – Transportation and Traffic	It is recommended that an analysis of existing road conditions and bridge weight capacities be conducted prior to project implementation to determine whether these facilities would be able to withstand the weight and frequency of the truck trips during the dam deconstruction period.
	Following the construction work, an analysis of post project condition of the roadways and bridges utilized for the haul routes should be completed to determine if the facilities sustained any damage that should be repaired.
	The construction plans would include a note that the contractor shall keep streets affected by the construction free of dirt, sediment, or mud. In addition, the contractor may be directed to perform street cleaning periodically or on a regular interval if excessive amounts of dirt or mud are present along the street.
	Local ordinances regulating the operation of oversize or overweight vehicles on local streets would be followed.
5.11 - Air Quality	Ensure that construction equipment, on-road construction equipment, and trucks used to transport materials to or from the construction sites are equipped with engines that meet the applicable emission standards.
	Reduce unnecessary idling through the use of auxiliary power units, electric equipment, and strict enforcement of idling limits.
	The contractor shall be responsible for providing dust control measures. Dust control operations shall be performed on a periodic basis and/or as directed by the owner to alleviate or prevent the fugitive dust within the project work limits.

Table 6-2. Mitigation Measures

	The contractor shall keep streets affected by the construction free of dirt, sediment, or mud. The Contractor may be directed to perform street cleaning periodically or on a regular interval if excessive amounts of dirt or mud are present along the street.
5.12 – Noise	The Contractor would be responsible for maintaining all construction equipment to comply with noise standards (e.g., exhaust mufflers, acoustically attenuating shields, shrouds, or enclosures).
	Construction activities would be scheduled to reduce impacts caused during sensitive time periods, i.e. nighttime, weekends, and holidays.
	Limit the number and duration of idling equipment on site.
	When possible, schedule truck loading, unloading, and handling operations to minimize on-site construction noise.
	Utilize shields, mufflers or other noise attenuation devices for equipment operated by internal combustion engines when possible.
	Keep the public informed when work would take place, keep a telephone log of complaints and review for opportunities to minimize noise emissions when appropriate.
	Notification of receptors prior to specific noise events (e.g. prior to start of construction, prior to dam removal, etc.).
5.13 – Human Health and Safety, Utilities and Public Services, Solid Waste	The Contractor shall be solely responsible for complying with all federal, state, and local safety requirements. Together with exercising precautions at all times for the protection of persons and property, it is also the sole responsibility of the contractor to initiate, maintain, and supervise all safety requirements, precautions, and programs in connection with the work.
	Construction workers would follow Occupational Safety and Health Administration (OSHA) regulations to reduce worker accidents during the dam removal and ICS construction activities.
	The contractor would be responsible for ensuring that construction vehicles enter and exit local roadways in a safe manner and, if necessary, provide flag persons in accordance with ODOT standards.
	Posting signage and erect fencing to exclude the public from construction areas.
	Before any work is started on the project and again before the final acceptance by the owner, the Engineer and the contractor shall make an inspection of all existing sewers which are to remain in service and which may be affected by the work.
	All existing manholes, catch basins, drains, sewers, and appurtenances inspected initially by the above-mentioned parities shall be maintained and left in a condition reasonably comparable to that determined by the original inspection.
	The contractor shall contact AEP transmission’s field representative a minimum of 48 hours prior to any construction activity in the vicinity of AEP’s transmission lines.

Table 6-2. Mitigation Measures

	The contractor shall use extreme caution while working in the vicinity of the staging and access areas on or near AEP's property and transmission lines.
	Modification of the river bed might be necessary near the raw water intake structure to maintain sufficient depth of flow over the structure during prolonged low water events. If required, this mitigation would consist of removing bedrock material to guide water to the intake. This would be done using heavy equipment and excavators to shape the bed to form a small channel that would direct water towards the intake in accordance with permitting requirements.

6.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible commitment of resources refers to the loss, as a result of the Project, of future options for resource development or management, especially of nonrenewable resources such as minerals and cultural resources (40 CFR 1508.1 1). Irretrievable commitment of resources refers to the lost production or use value of renewable natural resources as a result of the Project (40 CFR 1508.1 1). The Proposed Action and Alternative 3 of the Ballville Dam Project involve the irreversible and irretrievable commitment of material resources, energy, and cultural and historical resources.

To date, no irreversible or irretrievable loss of resources associated with the Project has occurred. Further, the Service will not approve any proposal that would result in irreversible or irretrievable loss of resources prior to publication of the ROD.

6.2.1 Irreversible and Irretrievable Commitment of Material Resources and Energy

Material resources used for the Project for all alternatives (Proposed Action, Alternative 1, Alternative 2, and Alternative 3) include building materials for temporary access roads, placement of temporary or permanent structures, and other elements described in Chapter 3. Construction of the Project would also require use of fossil fuels, a nonrenewable natural resource.

6.2.1.1 Proposed Action – Incremental Dam Removal with Ice Control Structures

Completion of the Proposed Action would result in an irreversible or irretrievable loss of some biological resources over the life of the Project, including the irretrievable loss of approximately 54 acres of current wetland habitat and 0.5 acres of forest habitat. As the project progresses, approximately 23-55 acres of new wetlands are expected form based on the restored river ecosystem in areas currently inundated by the impoundment. Additionally, the 0.5 acres of forested area would in part be seeded and returned to a natural state post construction, although would not be readily returned to forested area.

Additionally, the Removal of Ballville Dam would represent an irreversible and irretrievable loss of cultural and historic resources. This would be a permanent impact and a Programmatic Agreement has been written (Appendix D1) to guide the completion of mitigation efforts to accommodate this loss.

Lastly, in conjunction with the flood walls downstream, the Ballville Dam has been shown to aid in minimizing ice flooding risk for the City of Fremont and nearby residents. The removal of the dam would represent a loss of this function and possible increased risk of ice flooding. As such, the proposed removal of Ballville Dam includes plans to build an Ice Control Structure, designed and intended to replace this function currently provided by Ballville Dam to maintain the safety of communities in the area.

6.2.1.2 Alternative 1 - No Action Alternative

The No Action Alternative would result in the irretrievable loss of items described in Section 6.1.2.1 including materials needed to rehabilitate the structure and maintain it.

6.2.1.3 Alternative 2 - Fish Passage Structure

The Fish Passage Alternative would result in the irretrievable loss of items described in Section 6.1.2.1 including materials needed to rehabilitate the structure and maintain it. In addition, materials needed to build the fish passage structure and maintain it would also be required.

6.2.1.4 Alternative 3 – Dam Removal with Ice Control Structures

The Dam Removal with Ice Control Structure Alternative would result in the same irreversible or irretrievable loss of resources as the Proposed Alternative.

6.3 IDENTIFICATION OF PREFERRED ALTERNATIVE

The “preferred alternative” is a preliminary indication of the federal responsible official’s preference of action, which is chosen from among the Proposed Action and alternatives analyzed in an EIS. The preferred alternative may be selected for a variety of reasons (such as the priorities of the particular lead agency) in addition to the environmental considerations discussed in the EIS. The preferred alternative is not a final agency decision; rather, it is an indication of the agency’s preference. The final agency decision will be presented in the ROD after public comments on the FEIS have been received and considered as appropriate.

In accordance with NEPA (40 CFR §1502.14(e)) and based on consideration of agency and public comments on the DEIS, the Service has selected the Proposed Action – Incremental Dam removal with installation of ice control structure--as the preferred alternative. Of the alternatives evaluated in this FEIS, this alternative best fulfills the agency’s statutory mission and responsibilities while meeting the purpose and need. The selection of the Proposed Action as the preferred alternative is based on the following:

1) Implementation of the Proposed Action would restore natural hydrological processes, re-open fish passage, restore flow conditions, and improve overall conditions for native fish communities in the Sandusky River system both upstream and downstream of the Ballville Dam, restoring self-sustaining fish resources.

2) Implementation of the Proposed Action would also eliminate flood risks to the City of Fremont; eliminate liabilities associated with the current safety conditions of the Ballville Dam, manage the downstream movement of stored impoundment sediments; and restore Aquatic Life Habitat Use-Attainment for the lower Sandusky River.

6.4 IDENTIFICATION OF ENVIRONMENTALLY PREFERRED ALTERNATIVE

The environmentally preferred alternative is the alternative that would promote the requirements expressed in section 101(b) of NEPA. It is the alternative that causes the least damage to the biological and physical environment and that best protects, preserves, and enhances historic, cultural, and natural resources (CEQ 1981, Q6a). The environmentally preferred alternative has not been selected at this time. The Service will select an environmentally preferred alternative in the ROD.

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